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A

DICTIONARY

OF

PRACTICAL MEDICINE:

COMPRISING

GENERAL PATHOLOGY,

THE NATURE AND TREATMENT OF DISEASES, MORBID STRUCTURES, AND THE DISORDERS ESPECIALLY INCIDENTAL TO CLIMATES, TO THE SEX, AND TO THE DIFFERENT EPOCHS OF LIFE;

WITH

NUMEROUS PRESCRIPTIONS FOR THE MEDICINES RECOMMENDED

A CLASSIFICATION OF DISEASES ACCORDING TO PATHOLOGICAL PRINCIPLES, A COPIOUS BIBLIOGRAPHY, WITH REFERENCES;

AND AN

Appendix of Approved Formulae:

THE WHOLE FORMING A LIBRARY OF PATHOLOGY AND PRACTICAL MEDICINE, AND A DIGEST OF MEDICAL LITERATURE.

BY JAMES COPLAND, M.D.

Consulting Physician to Queen Charlotte's Lying-in Hospital; Senior Physician to the Royal Infirmary for Diseases of Children; Member of the Royal College of Physicians, London; Member of the Medical and Chirurgical Societies of London and Berlin, etc.

EDITED, WITH ADDITIONS,

BY CHARLES A. LEE, M.D.

100337

VOL. VI.

NEW-YORK:

HARPER & BROTHERS, PUBLISHERS,

82 CLIFF STREET.

1848.

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Edwin F. Hyde, M.D.
Jan. 25, 1847.

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A

DICTIONARY

OF

PRACTICAL MEDICINE.

PALATE.—Syn. *Palatum, P. molle et durum. Palais*, Fr. *Der Gaumen*, Germ. *Palato*, Ital. *The fauces.*

1. The mucous membrane covering the isthmus faucium, the soft palate or uvula, may be simply relaxed, or inflamed, or ulcerated. The hard palate—the bones of the palate may be also diseased—may be inflamed or ulcerated and carious, but chiefly as a symptom of serious constitutional disease, especially of syphilis, more rarely of scurvy.

I. Relaxation of the Palate and Uvula. —*Relaxed throat—Relaxed sore throat—Catarrhal relaxation of the throat—Relaxation of the fauces.*

Classif.—I. Class, I. Order (*Author*).

Defin.—*Uneasiness or soreness in the fauces, often with slight cough, without fever.*

2. This affection occurs *primarily*; but it also attends catarrhal and other inflammations of the mucous membrane covering those parts and the tonsils and pharynx. It is also symptomatic of catarrhal affections, of chronic bronchitis, of the several states of indigestion, and of numerous other diseases. The anterior fauces, or *velum palati*, appears more or less relaxed, very humid or watery, with little or no increase, or only with slight increase of vascularity, and the uvula is *elongated*, and hangs down upon the base of the tongue, often reaching to the epiglottis, and is sometimes also *œdematous*. More or less uneasiness in the throat, somewhat increased on deglutition, and occasionally a dry, tickling cough, particularly when the relaxed uvula irritates the epiglottis, are complained of. Indeed, the elongation of the uvula is generally the cause of the chief uneasiness attending relaxation of the palate or fauces, which often becomes a chronic disorder, especially in leucophlegmatic habits, and in persons who live irregularly and intemperately.

3. This affection, when it appears *primarily*, is generally *caused* by the same influences as produce inflammatory attacks of the palate or fauces (§ 6), and catarrhal affections. It rarely continues limited to these parts, but extends to the adjoining surfaces, to the pharynx, epiglottis, and larynx, causing a tickling cough, with slight mucous expectoration. It is frequent in spring and autumn, especially during humid states of the air, and usually, with relaxation or irritation of the Schneiderian membrane, constitutes a principal part of the common catarrhal affection. (See Art. Catarrh, § 7.)

4. The *treatment* necessarily depends upon the causes of the affection, and upon the nature of the disorders of which it is symptomatic. If a part of, or connected with, the common *catarrh*, the treatment advised for that disorder (§ 16, *et seq.*) should be employed, and a warm embrocation may be applied to the neck or throat. If it be a symptom of indigestion, tonics and astringent gargles, after biliary and intestinal secretions are evacuated, are generally useful. In persons subject to dyspepsia, in those of a relaxed habit of body, and in the irregular liver, relaxation of the soft palate and uvula often becomes chronic, whatever means of cure be prescribed, espccially if the liver be at the same time torpid, or otherwise disordered. In those persons the elongation is often attended by œdema of the uvula, and is productive of the most unpleasant part of the symptoms. Amputation of the part has, therefore, been often recommended, and too often allowed. Several persons who have had the uvula removed, have consulted me on account of disorders which had either continued or appeared after this part had been extirpated. The function of the uvula is evidently to convey the mucus and saliva over, and thereby to lubricate the base of the tongue and epiglottis; and when it is no longer, or is imperfectly discharged, not only those parts, but also the pharynx and glottis, become the seat of a chronic irritation more serious than that caused by an elongation, which a judiciously-directed treatment to the original source of disorder would remove.

5. If the elongation continue after such treatment, the hydrochloric or nitric acids, or both conjoined, may be given in the decoction of bark, or in sirup with a tonic tincture, and astringent gargles may be employed. If these fail, the uvula may be touched by a solution of the nitrate of silver, or by a powder containing the sulphate of alumina or sulphate of zinc.

II. Inflammation of the Palate.—Syn. *Palatitis, Isthmitis*, Hildenbrand. *Isthmitis simplex; Angina simplex; Cynanehe simplex; Angina gutturalis; Angina mitis; Angor Faucium; Inflammatio Palati; Inflammatio Faucium*, Auct. var. *Angine simple, Palatite*, Fr. *Die Rachenbraüne, Halsentzündung, Entzündung der Fauces*, Germ. *Sore throat, Quinsey, Inflammatory Sore-throat. Inflammation of the Fauces.*

Classif.—III. Class, I. Order (*Author*).

Defin.—*Redness of the soft palate, generally with elongation of the uvula, pain on swallowing, and slight fever.*

6. i. The Causes of Palatitis are chiefly those productive of Catarrh (§ 4, *et seq.*). The disorder is most prevalent in spring and autumn, in which seasons especially it is sometimes *epidemic*. It is an *endemic* in the vicinity of rivers, lakes, canals, and stagnant pools and

marshes. It may affect all ages and both sexes, but it is more frequently observed in young persons and in sanguine temperaments than in others. Cold and humidity, vicissitudes of temperature, weather, and season, cold applied to the extremities, or currents of air passing over the face and neck, and exposure of the neck or throat, especially after having been overheated, or to the night-dews and fogs, are the most common causes, particularly of the catarrhal form of the complaint. The ingestion of too hot or too cold, or of acrid substances, and the abuse of spirituous liquors, may also occasion inflammation of the fauces, in either its simple or its associated states.

7. Disordered states of the stomach and bowels, or accumulations of vitiated secretions in the biliary organs, or of excrementitious matters in the circulation, remarkably *predispose* to this affection. Palatitis, in either of its forms, is sometimes caused by, or is *symptomatic* of, disorder in these quarters, and it often attends, or ushers in, the eruptive fevers. Palatitis, in a *chronic*, *specific*, and generally *complicated form*, accompanies constitutional *syphilis*, and in its *acute* and *diffused states* it is frequently caused by the use of *mercurials*, especially if exposure to cold in any form concur to develop their effects.

8. ii. Symptoms.—Inflammation is seldom confined to the soft palate, constituting the *simplest form of palatitis* or angina; but frequently extends more or less to the surfaces of adjoining parts, to those of the tonsils and pharynx, and occasionally to those of the posterior nares, of the upper part of the œsophagus, and even of the glottis, although in a slighter degree. This is more especially the case in respect of catarrhal palatitis and in some epidemic visitations of the complaint.

9. *a*. The symptoms vary not only with the extent of surface that is affected, but with the constitution and habit of body of the patient, with the *character* of the affection, with the limitation of it to the mucous membrane, or with its extension to the sub-mucous cellular tissue. On inspection, the soft palate—the velum and pillars of the fauces, are seen red and somewhat swollen. Slight heat, pain, and uneasiness, with dryness at first, are complained of, and are increased on swallowing. The uvula is much elongated, and hangs down upon the base of the tongue. There is generally a tickling or hawking cough from this cause, or from the extension of the inflammatory irritation to the lips of the glottis. There are often more or less mucous expectoration, and hoarseness of voice or speech. The tongue is loaded, and red at its point and edges. The pulse is accelerated, the bowels confined, and the appetite impaired. Chills and flushes continue to be felt, alternately, for two or three days. After the first or second day, a more abundant secretion of mucus takes place from the fauces and their vicinity, and in a few days more the complaint ceases.

10. *b*. Such is the usual course of the *simple* and more *mild palatitis*, particularly in its catarrhal form. But the inflammation often is more severe, and is attended by a lower or more *asthenic* fever, or it continues a longer period than that just stated. It may extend to or more immediately affect the Eustachian tubes, the pharynx, &c., and thus be complicated with pain in one or both ears, and deafness, or with pharyngitis, and even, although rarely, with œsophagitis, especially when the stomach and liver are much disordered. In some cases the inflammatory irritation, of a catarrhal or more phlegmonous character, subsides in the fauces, while it continues in the pharynx, occasioning painful or difficult deglutition, or even the forcible regurgitation of substances attempted to be swallowed, through the nostrils. The inflammatory or catarrhal irritation, however, more frequently extends to the glottis, and thence, in delicate persons, sometimes to the bronchi, occasioning cough, and catarrhal or slight, or even acute bronchitis; but in these cases the pharynx is generally mediately affected.

11. *c*. In other *complicated* instances, in addition to redness of the surface of the tonsils and fauces, the *tonsils* are enlarged, chiefly owing to effusion of lymph and serum under the mucous membrane in the connecting cellular tissue; and, in many cases, more or less tumefaction of the fauces is produced by the same cause. (See art. Tonsils.) When the disease is thus more deeply seated, more pain, uneasiness, and difficulty of swallowing are experienced, and the patient opens his mouth with an increase of pain. A copious secretion of mucus, mixed with a ropy saliva, takes place, and as this becomes less abundant and thicker, it sometimes also appears slightly puriform, especially in children. In these acute states, the symptomatic inflammatory fever is usually more fully developed; and, if they are *complicated* with inflammation of the tonsils, as they very frequently are, this fever assumes a highly inflammatory character, particularly in children and young persons.

12. *d*. In cold, humid, and low situations, seldom in sporadic or in few instances, more frequently in an epidemic form, the inflammation is, apparently, more confined to the mucous membrane of the palate and adjoining parts than in others, or in the common sporadic or phlegmonous cases; and a grayish albuminous fluid is effused upon the inflamed surface, which immediately concretes into a false membrane. In this complication, the constitutional disturbance is extremely great, the powers of life often quickly sink, and the inflammation spreads rapidly over, if it does not simultaneously attack the mucous surface of the whole throat, of the soft palate, tonsils, pharynx, and even the Eustachian tubes, often extending, also, to the larynx and trachea, thereby inducing one of the forms of *croup*. (See art. Croup, § 16.) In some cases, the inflammation spreads down the œsophagus also, particularly in children. (See art. Throat.)

13. *e*. In the *thrush* and in other aphthous affections, the soft palate is implicated in common with the other parts of the throat and mouth, but this association of palatitis is fully considered in the article Thrush. Palatitis, moreover, may supervene upon *erysipelas* of the face, and assume a very acute and diffuse character, the inflammation extending to the pharynx and larynx, and placing the patient in the most imminent danger.

14. *f*. The *chronic states* of palatitis differ from the simple and more common form chiefly in the slighter grade and longer continuance

of the complaint. The surface appears irregularly red, or is reddened in patches, points, or striæ. Sometimes the vessels are more enlarged and conspicuous than usual, and the patches or points are of a more livid or dark hue. In some, dryness of the mouth and throat is complained of, and in others the mucous secretion is irregularly increased. This form of the complaint is generally prolonged by chronic disorder of the digestive organs, and by cachectic states of the system, or by constitutional disorder. Of the *specific forms* of inflammation of the palate, as the *acute form* caused by *mercury*, and the *chronic form* consequent upon the *syphilitic* infection, it is unnecessary to treat at this place. (See art. Throat.)

15. *g*. The *duration* of the *acute states* of palatitis is seldom long, and generally *terminates* in a few days by resolution. These states seldom pass into *suppuration* unless they are very acute or phlegmonous, or are caused by some acrid or powerfully stimulating substance brought in contact with the palate and fauces. They rarely terminate in *gangrene* unless in malignant *scarlatina*, and much more rarely in the membranous angina alluded to above (§ 12) as occurring epidemically, especially in certain localities. (See art. Throat.) I have observed this termination take place in two or three instances of erysipelas of the head and face, extending down the nostrils to the fauces. These cases occurred in persons addicted to spirituous liquors, whose liver and other digestive organs were much disordered.

16. *Ulceration* occurs chiefly in the more *chronic states* of the disorder, which are usually of long and very indefinite duration, owing to their dependance upon the constitutional maladies alluded to above (§ 14), on which maladies specific *inflammation* and *caries of the bone of the palate* may also supervene. Ulceration may occur also in the asthenic or more complicated and malignant states of acute inflammations of the throat, but not so frequently as it was formerly supposed to occur. (See art. Throat.)

17. iii. The *Prognosis* of palatitis is commonly favourable, unless it assumes a very asthenic and complicated character, or extends to adjoining surfaces, owing to impaired vital energy, to disorder of the digestive and assimilating organs, or to contaminated states of the circulating fluids, in which circumstances it is apt to induce dangerous laryngitis. When it is associated with, or is symptomatic of, the diseases named above (§ 14, 15), the prognosis will altogether depend upon the nature of the primary malady, the state of the constitutional derangement, and the appearance of the local affection.

18. iv. Treatment.—*a*. There are few cases of palatitis which are not more or less benefited by an *emetic*, especially if its operation be duly promoted by diluents or the tepid or warm infusion of chamomile flowers, or if the affection be simple and mild, or caused by gastric or bilious disorder. The emetic should generally be followed by an active purgative and the warm pediluvium, a diaphoretic medicine being given at bedtime, and continued as the presence of fever may suggest. These remedies, in the slighter cases, will generally remove the complaint; but, in the more acute, they may be insufficient, and general or local depletions may be also required, particularly when the patient is strong or plethoric, and the complaint complicated with tonsillitis. Antimonial diaphoretics, the solution of the acetate of ammonia, and the spirits of nitric ether will generally be of service in these cases; and when *blood-letting*, general or local, has been resorted to, *sinapisms*, or *embrocations*, will be applied to the neck or throat with marked benefit. In the more acute or phlegmonous cases, particularly in robust and plethoric persons, the blood-letting will advantageously precede the emetic; and it should be also followed by a brisk cathartic, or a powder containing calomel and antimony, given at bedtime, and a purgative draught in the morning.

19. *b*. In this early or acute stage of the complaint, astringent or stimulating gargles are seldom beneficial; but the vapour of warm water impregnated with camphor, or the vapour of chamomile flowers and poppy-heads, or of an infusion of hops, &c., passed through the mouth, will often be of service. Afterward, warm gargles, with small quantities of nitrate of potash, of the hydrochlorate of ammonia and camphor, will be of use.

20. *c*. After the acute symptoms have been removed, and relaxation of the parts, or a *chronic state* of *irritation* or *congestion* remains, *gargles*, containing the muriatic or sulphuric acid, or the sulphate of alumina, and one or more of the tinctures of myrrh, bark, capsicum, &c., will then prove beneficial. When the uvula is elongated, gargles, with the nitrate of silver, or a stronger solution of this salt, applied to the part by means of a small brush, or the applications already noticed (§ 5), are then most efficacious. If an œdematous state of the palate continue after the acute stage has subsided, or if it have existed from the commencement, the terebinthinate embrocation (F. 311) I have so frequently recommended may be applied on warm flannel around the throat, or a blister may be applied on the back and sides of the neck.

21. *d*. If the inflammation proceed to *suppuration*, giving rise to a small abscess in the cellular tissue of the velum, &c., an early outlet should be given to the matter, and afterward similar means to those already advised ought to be employed, or varied with the circumstances of the case, particularly the external applications mentioned above (§ 20).

22. *e*. If the disease assumes the *asthenic*, or diffused, or *complicated form* alluded to (§ 13), or if membranous *exudations* form upon the inflamed surface, permanent stimulants and tonics in the former case, and discutient and resolvent applications in the latter, as fully shown in the article Throat, are imperatively required, as the only means of preventing fatal sinking of the powers of life in the one, and extension of the disease to the larynx and trachea in the other. (See arts. Catarrh, Croup, Scarlet Fever, Throat, Thrush, and Tonsils, for important pathological connexions of diseases of the palate.)

Bibliog. and Refer.—*J. A. Foglia*, De Faucium Ulceribus, 4to. Neap., 1563.—*J. A. de Fonseca*, De Angina et Garotillo Puerorum, 4to. Comp., 1618.—*Th. Bartholinus*, Exercitat. de Angina Puerorum, &c., 12mo. Paris, 1646.—*S. P. Hilscher*, De insigni Raucidinis Remedio (*Vapore Aquæ calidæ*), in *Halleri* Dissert. ad Med. pert., vol. i. Jenæ, 1747.—*J. Wall*, Method of Treating the Sore

Throat, 8vo. Worcester, 1751; and in Med. Tracts, Oxford, 1780.—*J. Chandler*, Of the Disease called a Cold; also of the Putrid Sore Throat, &c., 8vo. Lond., 1761.—*F. Penrose*, Dissert. on the Inflammatory, Gangrenous, and Putrid Sore Throat, 8vo. Lond., 1766.—*S. Bard*, Researches on the Nature, Causes, &c., of Sore Throat, 8vo. New-York, 1771.—*W. Saunders*, Observations on Sore Throat and Fever, 8vo. Lond., 1778.—*R. Saunders*, Observ. on the Sore Throat in the North of Scotland in 1777, 8vo. Lond., 1778.—*T. Reeve*, An Essay on the Erysipelatous Sore Throat, 8vo. Lond., 1789.—*Renauldin*, Dict. de Sc. Med., t. ii.—*V. N ab Hildenbrand*, Institut. Practico-Medicæ, &c., t. iii., p. 136.—*Roche*, Dict. de Med. et Chirurg. Pratiques, t. ii.—*Sasche*, Encyclop. Wörterb., b. ii.—*Symonds*, in Libr. of Medicine, vol. iv., p. 46.—(See, also, Bibliog. and Refer. to arts. Catarrh, Croup, Scarlet Fever, Throat, and Tonsils.

PALPITATION.—See article Heart—*Functional Disorders of.*

PANCREAS.—Syn. Παγκρεας (from παν, all, and κρεας, flesh). *Pancreas*, Fr. *Gekrösdrüse*, *Pankreas*, Germ. *Pancreas*, Ital.

1. *The diseases of the Pancreas* have attracted but little attention, partly from the belief in their rare occurrence, and partly from the difficulty of recognising them during life. The *functions* of this viscus have been rather inferred than demonstrated. The similarity of the *secretion* produced by the pancreas to saliva has been shown by Magendie, Tiedemann, Gmelin, Lassaigne, Leuret, and others. But the pancreatic fluid contains no mucus, while saliva does. The former seems to contain a little free acid, the latter is nearly neutral. No analysis, however, of the pancreatic fluid from the human subject has been furnished of sufficient accuracy to be confided in; and all we know respecting it is, that it resembles the saliva, but differs somewhat from it in chemical composition. The precise amount of function performed by the pancreas not having been ascertained, it has been supposed that the fluid secreted by it dilutes the chyme, and assists in the change of chyme into chyle. This office, at least, may be conceded to it; but it is not improbable that it also aids in the complete conversion of chyle into blood, or in the formation of hæmatozine, as great emaciation and anæmia have been present in cases where chronic disease and obstruction of this viscus have been found after death. Drs. Tiedemann and Gmelin think that it assists in animalizing vegetable food not containing azote, as it contains a large quantity of highly azotized principles.

2. Formerly several diseases were considered to have their seat in the pancreas. Fernelius believed that this viscus was concerned in the production of diarrhœa, dysentery, cachexia, atrophy, languor, slow fevers, &c., and Riolanus added to these hypochondriasis and some other chronic disorders. Morgagni and Portal have adduced several instances of its change of structure; but some recent writers have made but little mention of its diseases. Although these diseases are seldom observed, and but rarely detected during life, owing to the want of precise knowledge of the functions of the organ, and to the situation and relations of it in respect of other organs, yet there are several reasons for inferring that they are more frequent than has been generally supposed. I shall, therefore, notice, 1st. Those *functional disorders* which may be imputed to the pancreas, although with much doubt and reservation; 2d. *Inflammations* of it, and the *consequences* they usually produce; and, 3d. Those *lesions of structure* not necessarily consequent upon inflammation.

I. Functional Disorders which may be imputed chiefly or partly to the Pancreas.

Classif.—1. Class, I. Order (*Author*).

Defin.—*Alterations of the quantity or quality of the pancreatic fluid so as to disorder the functions of digestion or defæcation.*

3. Although I have inferred that a material change in the quantity or quality of the pancreatic secretion will be productive of disorder of the stomach or bowels, still the exact characters of such disorders, and the differences subsisting between them and other disorders of these viscera, cannot be fully shown, or illustrated by satisfactory proofs.—*A. Deficiency of the pancreatic secretion—Torpor Pancreatis*—cannot be ascertained, although it very probably often occurs independently of organic lesion, and owing to impaired vital action of this gland. The extent of disorder, or the symptoms produced by this condition, hardly admit of remark; but it is not improbable that indigestion, costiveness, flatulence, and many of the symptoms I have assigned to functional disorder of the *duodenum* (see art. Duodenum, § 2, *et seq.*), may partly depend upon this state of function of the pancreas. Indeed, when the vascular and nervous connexions of this organ, the duodenum, the liver, and of the stomach are considered, it will be admitted that impaired energy of one or more of them will readily extend itself to the others. Emaciation, anæmia, or imperfect sanguification and assimilation, in any of their grades, may not improbably partly depend upon this state of function. In the experiments by Brunner of extirpating the pancreas, the alvine evacuations became scanty and indurated; and, although but little reliance can be placed upon the results of so violent an operation as this, still they correspond with rational inferences.

4. *B. Increased secretion of the pancreatic fluid, with or without change of its qualities or properties*, may take place independently of structural lesion of, although hardly without vascular determination to, this organ. Analogy supports this inference, although demonstration of the fact cannot be adduced; and it may, upon the same evidence, be admitted that some agents will have the effect of increasing this fluid, although the proofs of such an effect may be disputed. In some cases of diarrhœa the stools present appearances so closely resembling those of the salivary and pancreatic fluids, that it is not unreasonable to infer that they consist, at least in part, of an increased flow of the latter fluid. But when diarrhœa follows the suppression or disappearance of salivation, the stools presenting these appearances, the inference as to its nature and origin—as to its being actually a form of *pancreatorrhœa*—is still more conclusive. In those cases, also, where watery and ropy evacuations have followed the exhibition of chologogue purgatives, with the view of removing dropsical effusion, it is not unreasonable to suppose that a portion of these evacuations has consisted of an increased flow of pancreatic fluid.

5. Since I commenced lecturing in 1825, I have argued that the discharge from the stomach in Pyrosis (*see that article*) chiefly consisted of an augmented, and probably also of a

somewhat altered pancreatic secretion; that this secretion, owing to its properties or its quantity, or to both, had been regurgitated into the stomach, and that its accumulation there had occasioned pain and irritation, followed by its rejection. Thus I have viewed pyrosis as being more correctly a form of *pancreatorrhœa*, and have considered that alteration of the quality of the fluid has caused its ejection upward, instead of its passage through the bowels. More recently, MM. Mondière and Guersent have espoused nearly the same view of the origin of pyrosis, ascribing it to the irritating quality of the pancreatic fluid. It should not be overlooked, also, that Wedékind and Portal ascribed chronic diarrhœa and dysentery, with watery, colourless, or ropy discharges, chiefly to a morbidly increased secretion from the pancreas. But Dupuytren went still farther when he believed that the enormously abundant discharges in epidemic cholera proceeded from this viscus.

II. Inflammation on the Pancreas.—Synon. *Pancreatitis, Inflammatio pancreatis.—Pancreatite*, Fr. *Gekrösdrusenentzündung*, Germ.

Classif.—III. Class, I. Order (*Author*).

Defin.—*Deep-seated pain, somewhat below the pit of the stomach, or between this part and the umbilicus, extending to the back and under the left shoulder-blade; occasional vomiting of an albuminous and ropy fluid, great thirst, and symptomatic fever.*

6. The pancreas may, like other organs, be inflamed either in an *acute*, *sub-acute*, or *chronic form*. It is doubtful whether or not the second and third of these states, owing to the comparative mildness of the disease, and the frequent association of it with inflammation of adjoining parts, can be certainly detected during life—most probably only in a small proportion of instances; and it is not improbable that enlargement and induration of the organ are consequences of one or other of these states of inflammation, more particularly of the chronic. It has been doubted by MM. Bécour and Mondière whether *acute*, *sub-acute*, or *chronic* pancreatitis is of most frequent occurrence, but the point hardly admits of solution, nor is it of much practical importance.

7. i. Symptoms.—*a*. The phenomena attending the *acute* state of pancreatitis are chiefly dull, gravative, or even acute and deep-seated pain a little below the pit of the stomach, extending to the back and below the left shoulder-blade, increased by bending the body forward, and but little affected by pressure; a sense of constriction or of anxiety at the præcordia, and an unusual dryness of the fauces and thirst, with more or less symptomatic fever. There are other symptoms which are less constantly observed than the above, and there are some which occur more frequently in the course of the *sub-acute* and *chronic* states of the complaint than in that of the acute. Occasionally, a painful feeling of heat is complained of at the epigastrium, and sometimes a sense of tension in this region. There is every reason to infer that the pancreas is greatly tumefied when it is inflamed in either of the forms just mentioned, and hence jaundice, owing to the pressure of the tumefied gland upon the common bile-duct, may be expected sometimes to occur. In some cases, also, more or less tumour has been detected between the scrobiculus cordis and umbilicus, the tumour being hard, painful, deeply seated, and distinct from the liver and stomach. Occasionally there is a discharge of a ropy fluid from the stomach without retching, or even without nausea or anorexia; and in other cases both nausea and vomiting occur, a ropy mucous fluid, of a whitish-gray colour, occasionally tinged with bile, being thrown up. Sometimes a more copious flow of saliva than usual takes place. The state of the bowels varies. When a ropy fluid is discharged upward, the bowels are generally confined; but occasionally a mucous diarrhœa, or loose, ropy stools are observed.

8. *b*. The more *chronic states* of pancreatitis are recognised with difficulty. Many of the symptoms above detailed are present in a slighter or less manifest form; but several of them, particularly the pain, sense of tension, and heat, are either felt only after a meal, or are aggravated by it. In addition to these, flatulence, acrid eructations, or pyrosis, various dyspeptic symptoms, and pain or uneasiness in the back, are complained of. According to Heinecken, Eyting, Mondière, Fallat, and others, some degree of tumour, or fulness, may be detected in the epigastrium, and a ropy mucus, resembling saliva, is generally vomited every morning; or, when this is not observed, regular attacks of pyrosis occur, or evacuations from the bowels of matters partly resembling those which have been brought up by the œsophagus. In a few instances salivation has alternated with the above symptoms.

9. One question suggests itself, viz.: whether the augmented pancreatic secretion attends the acute, sub-acute, or chronic states of the disease? An increased discharge of this fluid appears often in connexion with inflammation of the gland; but whether it is antecedent to, coetaneous with, or consequent upon the inflammation, has not been determined. It is not unlikely that the most acute states of the disease, when the substance of the gland is the seat of the inflammation, are not attended by an augmented, but rather by a diminished secretion of the pancreatic fluid.

10. *c*. The *complications* of pancreatitis generally obscure, or altogether conceal, the disease of this viscus. Indeed, even when pancreatitis is the primary complaint, the inflammation may soon extend to the duodenum, or to the stomach, or to the liver, or to the root of the mesentery, or even to any two of these viscera; but probably the pancreas is more frequently affected consecutively of inflammation of one or other of these organs than primarily. The *symptoms* attending these complications have not been satisfactorily observed; but they may be inferred to consist of an association of many of the above symptoms (§ 7) with the phenomena characterizing inflammation of either of those viscera complicated with pancreatitis.

11. *d*. The *Terminations* and *Consequences* of pancreatitis are, 1st. Resolution; 2d. The effusion of coagulable lymph upon the surface of the organ; 3d. Suppuration; 4th. Gangrene; and, 5th. Chronic enlargement and induration.

12. (*a*) Harles supposed that a copious sweat or diarrhœa is critical in pancreatitis, especially if the latter present a ropy or mu-

cous character; but facts are wanting to prove these points. It is, however, not unlikely that the complaint is resolved in the milder cases by a copious secretion, causing more or less diarrhœa, or even vomiting or pyrosis, without the symptoms having been so prominent as to lead to the detection of the antecedent pancreatitis.

13. (*b*) The *effusion of coagulable lymph* upon the external surface of the pancreas gives rise either to a false membrane, or to adhesion of it, owing to the extension of inflammation to the external surface of an adjoining viscus, as the duodenum, pylorus, stomach, liver, spleen, mesocolon. These adhesions vary in thickness and form with their situation, age, organization, &c.

14. (*c*) *Suppuration* has been noticed by Lieutaud, Harles, Baillie, Portal, Moulon, Bécourt, and others; but it has been most accurately described by M. Gendrin, who states that it generally commences with infiltration of the interlobular tissue of the part of the organ affected. The glandular granules are soft, of a reddish-gray colour, and diminished in size, although the organ is enlarged. The capsule is much inflamed, and sometimes thickened by the formation of a false membrane. At an advanced period of suppuration the matter is collected in one cavity, generally of moderate size. The pus is occasionally intermixed with the pancreatic fluid, which exhibits a clear, yellowish appearance. In some cases the abscess is so large as to destroy the whole substance of the organ. In these cases M. Gendrin describes the matter as inodorous and creamy; but Portal states that it is sometimes very offensive.

15. Pancreatic abscess may be *discharged* either into the stomach or into the duodenum. It may pass even into the duplicature of the mesocolon, where it may be retained, or whence it may pass into the peritoneal cavity. It may even pass along the duct into the intestines, and be evacuated by stool. A case communicated by Dr. Haygarth to Dr. Percival seems to have been of this kind.

16. *Secondary abscesses*, or collections of matter after phlebitis, or consequent upon the absorption of matter in situations more or less remote, have been found in the pancreas in post-mortem examinations, but not so frequently in this viscus as in some others, as the liver, lungs, &c. They have been found chiefly after puerperal or uterine phlebitis, and after phlebitis consequent upon extirpation of the testicle. The occurrence of abscess in the pancreas, after extirpation of the testis, was first remarked by A. Petit and Portal; but its actual dependance upon inflammation of the veins after the operation was not known until more recently.

17. The *symptoms* indicating suppuration of the pancreas have not been precisely observed; but they probably differ in few respects from those attending suppuration in other internal parts, which is usually insidious and obscure. If an abscess of considerable size should form, so as to occasion a tumour, the situation of it may assist in indicating its nature; but if it should cause jaundice by pressing on the common duct, it might be mistaken for tumour in the liver, or for an over-distended gall-bladder, from occlusion of the common bile-duct, which latter generally attends enlargement or tumour of the pancreas of any kind.

18. (*c*) *Gangrene* has been very rarely observed in this organ. Two cases of it have been recorded by M. Bécourt, and one by M. Portal. In one of these the patient had been subject to occasional colicky pains, which were deeply seated above the umbilicus, and were sometimes preceded, at other times followed by nausea or by diarrhœa. He became emaciated, the pains were more acute, and the pulse rapid. The heat of the skin assumed an acrid or morbid character; the abdomen became tender; the urine scanty and red; and death followed a few days afterward. The pancreas was found of a livid red hue, very much softened, exuding from its whole surface a blackish, fœtid fluid, and gangrened almost throughout its extent. The stomach and duodenum were inflamed.

19. (*d*) *Enlargement* and *Induration* of the pancreas are probably also consequences of chronic inflammatory action or irritation, or of prolonged excitement, followed by a change of the nutrition of the organ; but more particular notice will be taken of these lesions in the sequel (§ 25).

20. ii. *The* Causes *of Pancreatitis* are not fully ascertained. Many foreign writers consider the abuse of mercury to be the most frequent cause of it; and, next to mercury, Hildenbrand views the use of tobacco, particularly the smoking and chewing of this noxious herb, as most influential. The immoderate use of spirituous liquors; a frequent recourse to purgatives; falls, blows, and other external injuries; and the extension of inflammation from adjoining organs, are probably also causes of this disease. Pancreatitis may even occur sympathetically of inflammation of the salivary glands. M. Andral found the pancreas greatly injected in a patient who died of fever with enlargement of the parotids. M. Mondière refers to a case in which these glands were remarkably enlarged. The enlargement disappeared rapidly, but was followed by symptoms of disease of the pancreas; and this disease, in its turn, was superseded by inflammation of the testicle. The enlargement of the parotid again appeared, the affection of the testicle subsided, and the application of a blister upon the parotid fixed the inflammation in this latter part, suppuration being the result. I have met with several cases in which inflammation, in a sub-acute or chronic form, seemed to exist in the pancreas, but chiefly in pale and debilitated persons, who had complained of prolonged disorder of the digestive organs. Only one opportunity, however, was afforded me of verifying the diagnosis by an examination after death; and in that case the pancreas was very much enlarged, and somewhat indurated. The following case, recorded by Dr. Schmackfeffer, will illustrate the history of acute pancreatitis:

21. A female, twenty-nine years of age, contracted syphilis, for which she was treated by means of corrosive sublimate. Violent ptyalism took place, four pounds of saliva being excreted in the twenty-four hours. As this secretion diminished, diarrhœa appeared and increased. Soon afterward the patient complained of anxiety and heat, with a fixed, obtuse,

and deep-seated pain at the epigastrium ; of loss of appetite, nausea, tension of the abdomen ; of great thirst and dryness of the throat, and rapid pulse. These symptoms were aggravated when the stomach was full. During five days some amelioration was remarked, but bilious vomiting supervened, and the pain and diarrhœa increased. The frequency of the calls to stool became remarkably great, a watery, yellowish fluid resembling saliva being voided. The deep-seated pain above the umbilicus prevented the patient from lying on her back and left side, and was increased by a full inspiration. Some days of relief followed, after which a violent increase of fever appeared, with a return of the diarrhœa, an acute pain at the epigastrium, and cough and orthopnœa. Bloodletting was prescribed. The following morning the parotids were hot and painful ; the mouth was burning, the pulse small, and the stools were suppressed. Mercury, camphor, and opium were ordered, and leeches, blisters, &c., to the parotids. Towards evening the breathing became stertorous, the anxiety extreme, the pulse thready and intermittent, the extremities cold, and the face Hippocratic. She expired in the night. The pancreas was found red, swollen, and somewhat more consistent than natural. It weighed eight ounces, and blood ran freely from it upon dividing it. The duct was dilated. The parotids were also inflamed.

22. iii. *The* Treatment of pancreatitis differs but little from that of other inflammations of an acute and sthenic character. General or local blood-letting, or both, according to the state of the pulse and vascular system generally, and to the condition of the patient ; warm baths, fomentations, and diluents ; cooling diaphoretics and sedatives, are the most appropriate means. If diarrhœa be present, it merely should be moderated, by absorbents and opiates, or small doses of Dover's powder, and the circulation determined to the surface of the body by promoting a copious perspiration. A large blister, sinapisms, or warm turpentine embrocations, placed over the epigastrium, will generally alleviate the deep-seated pains, as well as the vomiting, when these symptoms are present. If the disease appears to have passed into a *chronic state*, these external derivatives may be rendered more permanent by repetition, or by procuring a discharge from the blistered or inflamed surface ; and, if indications of suppuration of the gland occur, the constitutional powers should be supported, and absorption promoted by prescribing the iodide of potassium and liquor potassæ with sarsaparilla and tonic vegetable infusions or decoctions, a discharge from the external surface being also procured. The pale and anæmial state of some patients in whom I have had reason to suspect the existence of inflammation of the pancreas, seems to contra-indicate the propriety of general, and even of local blood-letting, and to suggest very different, if not opposite means of cure ; and in a very few instances I have prescribed the sulphate of iron with camphor and opium ; sulphate of quinine with camphor and hyoscyamus, or conium, or extract of hops ; the trisnitrate of bismuth with ipecacuanha and either of these narcotics, and similar medicines, with marked benefit ; but more or less doubt existed as to the exact seat and nature of the malady.

III. Structural Lesions of the Pancreas not necessarily dependant on Inflammation.

Classif.—IV. Class, I. Order (*Author*).

23. The *organic lesions* of the pancreas, as those of other organs, have been chiefly referred to diseased nutrition when they appear to differ from the more obvious consequences of inflammation. Still, this diseased nutrition, varying as it does in character, form, and results, must itself depend upon some pre-existing morbid state or states, originating either in the organic nerves of the part, or in the capillary vessels, or in the secreting apparatus of the part, or in these collectively—in the vitality, in short, of the organ. Modern pathologists, in grappling with this and several other subjects which have long been matters of discussion, have had recourse to new names and terms, believing that they afford explanations, even if they do not actually constitute discoveries. But the reader will soon be enabled to estimate the true value of terms or epithets when he reflects upon their meaning, and their applicability to visible phenomena and changes ; to deviations from the healthy condition, which are never stationary or exactly identical with one another, but varied in form, character, appearances, associations, morbid relations, and results, to an extent that precludes the possibility of description ; and he will readily detect what portion of sense and precise information may be concealed beneath the rubbish of phraseology, and the affected use of novel terms. Still, terms and names of some kind are conventionalities that must be resorted to, in order to convey accurate ideas of certain morbid conditions and their probable results ; but these should not be multiplied beyond the necessity of the occasion, nor be used when generally-received and well-understood words are altogether applicable.

24. i. *Atrophy* or *wasting* of the pancreas sometimes occurs, according to Siebold and Lobstein, at an advanced age. It is occasionally, also, the result of disease, either of itself or of adjoining organs. Dr. Lobstein records an instance of the pancreas being atrophied and somewhat indurated, independently of lesion of any other organ. Most frequently, however, the wasting is connected with organic disease of the liver, duodenum, stomach, or of the mesenteric glands ; or consequent upon tumours developed in its vicinity, as scirrous enlargement of the pylorus, aneurisms of the aorta, &c. Doctor Hull found the pancreas wasted, owing to the pressure caused by a scirrous tumour in the mesentery. M. Guerin observed this lesion produced by a similar cause ; Morgagni by a tumour in the liver ; M. Berjaud by aneurism in the aorta ; and M. Mondière by scirrous pylorus. In this last case, it is supposed that the atrophy of the pancreas is the result rather of interrupted or diminished function, owing to the small quantity of chyme passed into the duodenum, than of any pressure produced by the thickened pylorus. M. Darcy has adduced a case of *rabies* in which the pancreas was remarkably small. In a case recorded by Dr. Wolf, of a person who had complained of nausea, vomitings of bilious and mucous fluids, of a burning sensa-

tion along the œsophagus, of alternations of constipation and diarrhœa, and ultimately of excessive emaciation, the pancreas was found very small, indurated, of a grayish colour; its arteries being ossified, and its duct obstructed.

25. ii. *Hypertrophy* or *enlargement* is the most frequent lesion observed in the pancreas, but it is rarely seen without some change in the structure of the organ. Chronic inflammatory action, and the consequent deposition of albuminous lymph in the areolar or cellular tissue, especially the interlobular tissue, this lymph having become more dense by the absorption of its more fluid parts, and ultimately partially organized, are probably the changes constituting a large proportion of the cases of enlargement of this organ; and these, in a more advanced and indurated state, have not unlikely been mistaken for, and described as scirrus of the organ by several writers who have recorded instances of scirrous tumour in this situation. It is even not improbable that obstruction of the pancreatic duct may be followed by a form of enlargement which has not been accurately described. An out-patient of the South London Dispensary, under my care, in June, 1821, had complained of fever, pain below the epigastrium, of nausea, vomitings, thirst, emaciation, &c. She was pale, debilitated, and ultimately deeply jaundiced. A manifest tumour was detected in the lower part of the epigastrium. The body was examined after death by myself and Mr. Bryant, my colleague. The gall-bladder was distended by thick black bile, the common and pancreatic ducts were entirely obliterated by a remarkably enlarged and indurated pancreas. Upon examining the structure of this organ more minutely, it seemed as if the glandular structure was more dense than natural; the connecting cellular tissue was infiltrated with albuminous lymph, which had become condensed by the absorption of its more fluid parts, and the ramifications of the ducts were dilated and filled with the albuminous and more consistent constituents of the pancreatic secretion, the more watery portion having apparently been absorbed.

26. It is not unlikely that these more simple changes, giving rise to enlargement of the organ, whether consequent upon chronic inflammation or upon obstruction to the discharge of the pancreatic fluid, may be followed by other important changes, several of those about to be noticed actually originating in these. The infiltration of an albuminous fluid or lymph into the connecting cellular tissue; the subsequent organization, partially or fully, of this, and the growth of it afterward as the organization of it becomes more perfect; the changes produced by it from pressure or otherwise, upon the natural structure and secreting apparatus; and the alterations of organic nervous influence, of vascular action and nutrition, of which the organ is subsequently the seat, may reasonably be viewed as not altogether an insufficient explanation of several of the changes and transformations observed in this and other glandular structures. Several interesting cases and notices of enlargement of the pancreas have been recorded by Sewall, Crampton, Gregory, Abercrombie, Bécourt, Bedingfield, and others referred to in the *Bibliography*.

27. iii. *Softening* of the pancreas, as well as enlargement, may result from acute inflammation; but it has been observed chiefly in scorbutic and scrofulous persons. M. Portal found this organ remarkably softened, without being either reddened or enlarged, in two children who died in measles. This change has been also remarked in fatal cases of confluent smallpox, and of malignant scarlet fever. I have observed it in malignant remittent fever and in scurvy, but only in common with softening of several other organs, as the spleen, &c. I am not aware of any instance having been recorded of *hæmorrhage* into the substance of the pancreas, independently of *wounds* or *rupture* of the organ.

28. iv. *Induration* of the pancreas may exist independently of scirrosity, and it is extremely doubtful whether or not simple induration is the commencement of scirrus, as supposed by some writers. Some degree of induration sometimes exists with hypertrophy; but, in simple induration of the glandular granules of the organ, increased bulk is rarely observed, the connecting cellular tissue being neither thickened nor indurated, as in cases minutely described by MM. Mondière and Bécourt, in which the granules only were remarkably indurated, the connecting cellular tissue being sound. The subject of one of these cases died of chronic duodenitis. In incipient scirrus a portion only of the organ is affected, and the cellular tissue is either primarily attacked or early implicated. Although simple induration of the pancreas is thus independent of, yet it is sometimes associated with hypertrophy, as in a case already noticed, and in another which was more recently observed, in neither of which, nor in the two cases described by Dr. Sewall, did the disease present a scirrous character.

29. v. *Cartilaginous induration* or *transformation* of the pancreas was met with by Morgagni, Andry, and Lilienhain, who have described the organ as somewhat enlarged, its surface irregular, and its substance of a cartilaginous consistence. This change was found in persons who long experienced nausea, vomitings, thirst, pain at the epigastrium, costiveness, &c., and was probably the remote consequence of chronic inflammation.

30. vi. *Concretions* similar to those found in the salivary glands and ducts have been met with in the pancreas in rare cases. These are either small and numerous, or few and large. In some instances they are found apparently in the substance of the organ, but probably formed in the ramifications of the ducts; but more frequently they are lodged in the excretory duct. Graeffe found seven of the size of pease in the right portion of the gland. Galeali found about twenty contained in a cavity the size of a hen's egg, in the head of the viscus. Portal met with a dozen, some of which were as large as a nut. The gland was greatly enlarged, and the duct much dilated. The concretions were rounded, whitish, and when reduced to a powder were dissolved by boiling water. They had an insipid taste. Merklin found a concretion as large as an almond; and Meckel states that he has seen the organ changed to an almost tophaceous mass. Those commonly found in the excretory duct are often large, about the size of a nut, and composed

of the carbonate or phosphate of lime. They are generally whitish, and their surfaces irregular. By obstructing the duct, they occasion swelling and enlargement of the gland. The salivary secretion continuing for a time after the obstruction, the ramifications of the obstructed duct are distended by this fluid, which becomes inspissated by absorption of the watery parts of it, and thus a form of enlargement already noticed (§ 25) is produced.

31. vii. *Tubercular formations* have been seen in the pancreas by several modern pathologists, and have been fully described by Nasse, Bouillaud, Reynaud, Mitivie, Harles, and Bécourt. They appear to have been attended by hectic fever, emaciation, occasional salivation and diarrhœa, and by pain at the epigastrium, or a little below it, and to have existed chiefly in the first and second stages of development.

32. viii. *Transformation of the pancreas into a fatty substance* has been observed by MM. Dupuytren, Lobstein, and Bécourt. This lesion is different from, and should not be confounded with, an accumulation of fat in the cellular tissue uniting the lobes and lobules. The change may affect either a part or the whole of the organ, as in the cases observed by the writers just cited. The symptoms remarked in those cases were, a sense of oppression at the epigastrium, pain between the umbilicus and pit of the stomach, constant cardialgia, salivation, and jaundice.

33. ix. *Cysts* have been found in this organ by Morgagni, and M. Bécourt has described a preparation in the museum of the medical school at Strasburg of a cyst of a very large size in the body of the viscus.

34. x. *Scirrus* and *carcinoma* of the pancreas have been observed by most of the writers referred to in the *Bibliography;* but many of the cases adduced as scirrus have been more correctly instances of enlargement, with induration. True scirrus generally affects, or commences in, a part only of the organ; but it may extend to the whole. This malady appears to attack the pancreas primarily in a large proportion of cases, as it alone has been found affected; although in others it has also been found in other parts. In a few cases the pancreas only is diseased; but in the great majority, lesions of some kind—non malignant or malignant—slight or extensive—are also observed in other, most frequently in adjoining organs, particularly the duodenum, the stomach, the pylorus, the liver, the spleen, the mesentery, the adjoining or connected ducts, blood-vessels, &c., or any two or more of these or other viscera. Scirrus of the pancreas may exist without any increase of size. Most frequently, however, the bulk of the organ is more or less, or even very remarkably enlarged. The scirrous pancreas sometimes adheres to one or more adjoining organs or parts; most frequently, when the scirrus has gone on to *ulceration*, a result not frequently remarked, probably owing to the circumstance of scirrus and the lesions associated with it in other organs usually terminating fatally before ulceration commences. Cases, however, of open cancer of the pancreas have been recorded by Hasenoehrl, Bertheau, Mattheis, Mabille, Van Doeveren, Lerminier, Portal, and Vidal. Scirrous enlargement of the pancreas is generally attended by very obstinate vomiting, particularly when the pylorus or duodenum is much pressed upon or constricted by it, and by acute pain in the back. Instances not only of constriction of these and of the common bile-duct, causing deep jaundice, but also of compression of the aorta by this lesion of the pancreas, have been recorded by Rahn, Portal, Salmade, and Brière de Boismont. The compression and constriction of the aorta may even occasion aneurismal dilatation above the seat of constriction, as seen by Portal and Salmade.

[The following case of scirrus of the pancreas, recently reported by Dr. Battersby, is too instructive to be omitted.

"The subject of the case was a woman between fifty-five and sixty years of age, who had been remarkable for her *embonpoint*, and had always enjoyed good health until two years previously, when she became subject to severe pains in the back, which affected also the shoulders and arms, and were supposed to be rheumatic. After the lapse of a year, there was discovered in the epigastric region a deep-seated pulsating tumour, about the size and shape of an orange, having a regular diastolic enlargement synchronous with the pulse, and a well-marked bruit de soufflet. Her disease was, in consequence, considered to be aneurism of the aorta. She also suffered from fluid eructations, and an obscure, deep-seated pain. Dr. Battersby found her extremely emaciated. There was a marked fulness in the epigastric region, in which was to be felt a deep-seated, solid, and fixed induration, having a flattened surface and defined outline inferiorly. It was without pulsation, but a bruit de soufflet was audible on the application of the stethescope over it in the course of the aorta. She suffered much from constipation, from symptoms of contraction of the colon, and from temporary dysphagia. There were occasional eructations of a clear watery fluid, and her mouth seemed always full of saliva. The tongue was pale and clean. Before death the limbs became highly anasarcous, and there was some fluid in the abdomen. On examination after death, the colon and cardiac orifice of the stomach were found narrowed. The pancreas was universally hard and enlarged, and had lost every trace of its natural structure. Near the centre of this gland, and at its lower edge, existed a thin, translucent, horny cyst, which was slightly prominent, about the size of a walnut, and lay directly over the aorta. Its base was surrounded by a hard, cartilaginous, scirrous formation, which in part projected into it. The rest of the gland was composed of a less solid, but unyielding, heavy substance, apparently made of dense, closely-interwoven membranous bands. The lining membrane of the aorta was diseased, and in some points was eroded. The error committed of mistaking the tumour of the pancreas for aneurism of the aorta was due, no doubt, to the early development of the cyst, which, probably in the progress of the disease, had its fluid contents lessened by the encroachment of the scirrus, while the close union of the latter to the spine having removed the impulse of the aorta, towards the conclusion no other symptom remained but the bruit de soufflet, which was not of itself likely to mislead. Ptyalism, as remarked by Dr. Battersby

in this case, has not been observed, in connexion with diseases of the pancreas, by any writer in our language, so far as he is aware, although it has been frequently noticed by our continental brethren. Dr. B. thinks that this symptom may serve as a guide towards the diagnosis of pancreatic diseases, of which the other symptoms are in general very obscure and ambiguous, and in this he is confirmed by the facts of a case communicated recently to him by Mr. Robert Macdonnell, in which the cleanness and great moisture of the tongue and mouth attracted the attention of three German physicians in attendance on Dr. Graves's Clinique, who, from this circumstance principally, were led to pronounce the patient to labour under scirrus of the pancreas; and although the post-mortem examination showed that the disease was not confined to the pancreas, yet that gland was sufficiently engaged to confirm the accuracy of their opinion, founded on the extreme moisture and the pale and macerated appearance of the tongue."—*Dublin Med. Press*, April 17, 1844.]

35. xi. *Fungo-Hæmatoid disease* has been found in the pancreas in three cases by Dr. Abercrombie, and in single instances by Dr. Bright and others. I found this lesion in the pancreas of a boy about fourteen years of age. Several other organs were also the seat of this malady.

36. xii. *Melanosis* has been found in a few cases; but this disease has not been accurately observed and described as it affects the pancreas.

37. xiii. *The symptoms of organic lesions of the pancreas* are often very obscure; and, although it may be inferred, from the grouping of morbid phenomena, that the pancreas is the seat of disease, the exact nature of that disease, or the extent of lesion of other organs associated with it, can rarely be recognised during life. The symptoms which are most frequently observed, although not constantly, are cardialgia, nausea, vomiting, and other disorders of the stomach; pain at the lower part of the epigastrium; tumour in the same situation; salivation; diarrhœa, or constipation; emaciation; and jaundice.

[*Apoplexy of the Pancreas* has been observed by Dr. Roberts: the particulars of the case are recorded in the fourth number of the "*Bulletin de la Societé Anatomique*. The subject was a female who was affected with a hæmorrhagic diathesis, and who died on the twelfth day of her illness, having laboured for some time under violent oppression of the chest, attended with copious expectoration of blood. Depositcs of blood were found not only in the pancreas, but in nearly every organ in the body, even to the kidney, ovary, mammary gland, and omentum.

Internal hæmorrhage into the pancreas is recorded by Storck in his *Annus Medicus*. The pancreas weighed thirteen pounds, and was converted into a membranous sac full of blood, partly grumous, and partly organized. The appearances were doubtless owing to the rupture of a small blood-vessel in the interior of the diseased gland. The subject, a female aged twenty-four years, had been subject to frequent fainting fits, with great anxiety and palpitation in the region of the heart, and was finally carried off, after a period of three months and a half, by an attack of bilious vomiting and diarrhœa. A large, heavy, and irregular tumour had been latterly observed in the epigastric region.]

38. (*a*) *Cardialgia*, and other symptoms of severe indigestion, had been early remarked in all the cases of organic lesion of the pancreas which I have had an opportunity of observing. The appetite at this early period was not usually impaired; it was even increased in some cases. Thirst was often complained of at an early stage, but not so much as in the acute state of disease. To these symptoms generally succeeded *nausea* or *vomiting*, either occasionally or at intervals. At first only eructations of a ropy fluid occurred; but subsequently vomitings, two or three hours after a meal, supervened. As the disease proceeded to a fatal issue, the vomiting was more frequent and obstinate.

39. (*b*) *Pain*, deep-seated in the lower part of the epigastrium, with a sense of heat, was also an early symptom, and was most complained of when the stomach was empty. It was aggravated at intervals, especially by flatulence, which frequently attended it, and was relieved for a time by eructations, which sometimes were attended by a discharge of a ropy fluid, sometimes insipid, at others acid. The pain usually extended to the spine, and to either hypochondrium. It seems to have been most severe in the cancerous cases, as in that described by M. Andral, in which it was very acute, and seated chiefly in the back, whence it irradiated to the chest and abdomen. In some instances, as observed by Dr. Sewall and others, it was increased by the vertical position, the patient generally bending forward to obtain relief. In order to ascertain the exact seat of pain, and to distinguish between disease of the pancreas and that of the pylorus, the epigastrium should be examined or pressed upon at the same time that the left hand presses firmly against the back. When the pylorus is affected the pain is felt more superficially, chiefly to the right of the epigastrium, is more aggravated by pressure than in disease of the pancreas, and is more relieved by vomiting; but disease of both parts is often associated.

40. (*c*) *Tumefaction* between the pit of the stomach and the umbilicus was found deep-seated, in the more emaciated subjects, when there was considerable enlargement of the organ. The tumour was generally, at first, very difficult to detect. When this is the case the examination should be made in the manner just now directed. In some instances, in addition to a tumour, there was a feeling of weight in the back, with a sense of pulsation, which was perceived externally, or felt by the hand placed on the epigastrium.

41. (*d*) *Salivation* occurs in both acute and chronic diseases of the pancreas, and in both the early and late stages of the latter. J. P. Frank saw a case in the last stage of emaciation from scirrus of this organ, in which six pints of saliva were discharged daily. Similar, but not so remarkable instances, have been recorded by others. Salivation is one of the most frequent symptoms; it was sometimes followed and relieved by vomitings; and it was also often superseded by diarrhœa in the cases which I have seen.

42. (*e*) *Constipation* and *diarrhœa* are generally present at certain stages of organic lesion of this organ. They often alternate; but constipation is commonly observed at an early period, and is obstinate. Diarrhœa presents unusual characters, the stools being frothy and ropy. Dr. Bright has directed attention to a very remarkable state of the evacuations when scirrus or other disease of the pancreas is associated with ulceration, or other lesions of the duodenum. In several cases of this complication, the stools contained much semifluid, fatty, or oily matter, which was of a fœtid odour, and somewhat resembled adipocere.

43. (*f*) *Emaciation* and *anæmia*, the former especially, always attend the advanced stages of chronic alterations of the pancreas. Doctor Pemberton considered that emaciation is more extreme in these than in any other malady. The anæmia is also remarkable, and is obviously owing to the impaired chylification resulting from the disease of this organ.

44. (*g*) *Jaundice* is a frequent symptom, particularly where the head or the whole of the organ is enlarged. The pressure on the ducts is often, also, attended by great distention above the seat of pressure and accumulation of bile in them and in the gall-bladder. In these cases, the tumour caused by the distended gall-bladder may be distinguished from that caused by the diseased pancreas, by the more superficial position of the former.

45. xiv. *The treatment of chronic maladies of the pancreas* is very generally inefficacious. Hoffmann placed more reliance on diet than on medicine for these diseases. Pemberton entertained a similar opinion, and recommended a vegetable and milk diet for them. Still, there is reason to believe that in an early stage, and when not malignant, they may be influenced by medical treatment; more especially by local blood-letting, by diaphoretics, by cooling or saline purgatives when the bowels are costive, and by absorbents and antacids, with ipecacuanha and opiates, or with Dover's powder, when the bowels are relaxed. Blood-letting can be ventured on only at an early period of the malady, and even then it should be local. The anæmia attending an advanced period of these lesions forbid a recourse to it subsequently. Besides determining to the surface of the body by diaphoretics, by warm or vapour baths, and by ipecacuanha, with opium or other narcotics, blisters may be applied over the epigastrium, or in the vicinity, and a discharge procured from them for a considerable time, or an issue may be formed. If there be any evidence of deep-seated tumour, the iodide of potassium may be prescribed with liquor potassæ and conium, or with other medicines, according to the peculiarities of the case; an external drain or purulent discharge being procured in any way that may be least unpleasant.

46. When the disease is attended by vomitings, opiates, creasote, the hydrocyanic acid, and small doses of calcined magnesia, with a few drops of laudanum in mint water, may be severally prescribed. Dr. Carter recommends a drachm of the tincture of senna, with five minims of laudanum, in an aromatic fluid; or small doses of calumba, soda, rhubarb, and capsicum, conjoined in the form of powder. Mercurials ought not to be employed, and drastic purgatives are generally injurious. When the bowels are confined, enemata are preferable to purgatives, unless those of a mild kind, taken by the mouth.

47. If the disease be inferred to be of a scirrous nature, the remedies just enumerated, with conium, the iodide of potassium in small doses, and liquor potassæ, or the liquor hydriodatis hydrargyri et arsenici, with tinct. opii, may be tried; and unpleasant symptoms should be alleviated as they appear. In the more chronic cases, the deobstruent and alkaline *mineral waters* may be taken, and subsequently those which contain iron, along with deobstruent salts. The *diet* should be light, nutritious, and after short intervals, but in small quantities. When an external drain or discharge is continued for a long time, the diet should be more nutritious than in other circumstances; and wine in moderate quantity may be allowed, according to the state of the case. Change of air, sea air, and gentle exercise in a dry atmosphere, are generally beneficial, especially when aided by the use of deobstruent and chalybeate mineral waters.

Bibliog. and Refer.—*De Graaf*, Tract. Anat. Medicus de Succi Pancreatici Natura et Usu., 8vo. Leid., 1664.—*F. Hoffmann*, Dissert. de Pancreatis Morbis, 4to. Halæ, 1713; et Opera, Suppl., ii.—*J. C. Brunner*, Experimenta Nova circa Pancreas, 8vo. Lugd. Bat., 172.—*Morgagni*, De Sed et Caus. Morb., Epist. xxx., arts. 7, 10, 110. —*Lieutand*, Hist. Anat. Med., t. i., p. 245.—*J. R. Rahn*, Diagnosis Scirrorum Pancreatis Observationibus Anat. Patholog. illustrata. Gött., 1796; et in *Brera's* Syll. Select. Opusc., t. xi., p. 99.—*Portal*, Cours d'Anat. Médicale, t. v., p. 355.—*G. C. M. Hoffmann*, De Pancreate ejusque Morbis, 8vo. Nuremb., 1807.—*Pemberton*, Practical Treatise on the various Dis. of the Abdominal Viscera, 2d ed., 8vo., p. 63. Lond., 1807.—*J. P. Frank*, De Curandis Hom. Morbis Epitome, t. v., p. 87.—*C. F. Harles*, Ueber die Krankheiten des Pankreas, 4to. Nuremb., 1812. —*J. Bedingfield*, a Compendium of Medical Practice, &c., &c., 8vo., p. 197. Lond., 1816.—*T. Sewall*, in New England Journ. of Med., &c. Jan., 1813; and in London Med. and Phys. Journ., vol. xxxi., p. 194.—*Dupuytren*, in Biblioth. Med., t. xiii., p. 20.—*Hasenœhrl*, Hist. Med. Morb. Epid., p. 60.—*Matheis*, Ratio Instituti Clinici Romani, 8vo. Roma., 1816.—*M. Gelcen*, Journ. Complém., &c., t. xi., p. 12.—*E. Percival*, Inflam. and Enlargement of the Pancreas; in Trans. of Fellows and Licentiates of College of Phys. of Ireland, vol. ii., p. 128.—*J. Crampton*, in ibid., vol. ii., p. 134.—*Schmackfeffer*, Observationes de quibusdam Pancreatis Morbis, 4to. Halle, 1817.—*V. N. ab Hildenbrand*, Institutiones Practico-Medicæ, &c., t. iii., p. 366.—*Darcy*, Mem. de Méd. et Chirurg. Militaires, t. x., p. 87.—*Berjaud*, in ibid., t. xviii., p. 262.—*Lilienhain*, in Revue Médicale, t. iii., p. 130, 1826.—*Cruveilhier*, Essai sur l'Anat. Pathol., 8vo., t. i., p. 193; et Anat. Pathol., fol., livr. 15, 19.—*Sandwith*, in Edin. Med. and Surg. Journ., vol. xvi., 380.—*Martland*, in ibid., vol. xxiv., p. 493.—*J. Abercrombie*, in Edin. Med. and Surg. Journ., t. xxi., p. 243; and on Dis. of the Abdominal Viscera, 8vo. Edin., 1828.—*Rennes*, in Archives Génér. de Méd., t. vii., p. 82.—*Brière de Boismont*, in ibid., t. xvi., p. 132.—*Bouillaud*, in ibid., t. ii., p. 193.—*Reynaud*, in ibid., t. xxv., p. 165.—*Lobstein*, Anat. Pathol., t. i., p. 193.—*Tacheron*, Recherches Anat. Pathol., t. i., p. 335, 345.—*Gendrin*, Hist. Anat. des Inflammat., t. i., p. 262.—*Heyting*, in Philadelphia Med. Journ., vol. viii., p. 198.—*Duponchel*, Lond. Med. Repos., vol. xxii., p. 162. —*J. G. Bécourt*, Recherches sur le Pancreas, ses Fonctions, et ses Altérations Organiques, 4to., fig. Strasb., 1830. —*Carter*, Cyclop. of Pract. Med., vol. iii., p. 237.—*Jolly*, Dict. de Med. et Chirurg. Prat., t. xii.—*W. Lawrence*, in Trans. of Medical and Chirurg. Society of Lond., vol. xvi., p. 367.—*R. Bright*, in ibid., vol. xviii., p. 1.—*J. J. Bigsby*, in Edin. Med. and Surg. Journ., vol. xliv. p. 85.—*Wolf*, in Gazette Médicale, t. v., p. 42, 1837.—*W. Thomson*, in Library of Medicine, vol. iv., p. 200.—*J. T. Mondière*, Recherches pour servir à l'Histoire Pathol. du Pancreas, in Archives Génér. de Méd., 2d ser., t. xi., p. 36, 265; t. xii., p. 133.

[Am. Bibliog. and Refer.—*W. B. Ranney*, Case of Pancreatic Sarcoma, in Boston Med. and Surg. Journ., vol. xiii., p. 42.—*Charles Knowlton*, in Boston Med. and Surg. Jour., vol. xxix., p. 379: a very interesting, but obscure case of scirrus of the pancreas. The pancreas was covered externally with closely-adherent cellular and adipose matter,

and internally it had wholly lost its reddish, watery appearance, being gristly, dense, and heavy. It was firmly adherent to the duodenum, and diseased throughout. The patient, a man of 69, was extremely pallid, and subject to bilious diarrhœa.—*J. Bell* and *W. Stokes*, Lectures on the Theory and Practice of Physic, 2 vols., 8vo., 3d ed. Phil., vol i., p. 551–554. — *Battersby*, in Am. Journ. Med. Sci., vol. viii., N. S., p. 206.—*Ibid.*, vol. iv., N. S., p. 178.—*R. Dunglison*, in Cycloped. Prac. Med., vol. iii., p. 457; et Practice of Medicine, 2d ed., vol. i., p. 581. Phil., 1844.—Archives General., 1336.—*S. D. Gross*, Elements of Patholog. Anat., &c., 2d ed. Phil., 1845, p. 689.]

PARALYSIS.—Syn. Παράλνσις (*resolutio, dissolutio*), πάρεσις; *Resolutio nervorum*, Celsus. *Paralysis*, Pliny, et Auct. Recent. *Carus paralysis*, Good. *Paralysie*, Fr. *Lähmung*, Germ. *Paralisia*, Ital. *Palsy*.

Classif.—IV. Class, III. Order (*Author in Preface*). See, also, Apoplexy.

1. Nosological Defin.—*A diminution or loss of motion, or of sensibility, or of both motion and sensibility, in one or more parts of the body.*

2. Pathological Defin.—*Disease generally organic, either of the cerebro-spinal axis and ramifications, or of adjoining parts implicating these, so as to impair or altogether to abolish motion or sensation, or both, in a part, or more extensively throughout the frame.*

3. Paralysis presents itself in several *forms* and *states*, according as the *sensibility* or the *power of motion, or both*, may be affected; and according to the *degree* and the *extent* of the affection. It varies thus in grade, character, and extent, from the numbness or weakness of a single joint or finger, to a complete apoplexy, in which the sensation and motion of the whole body are abolished. These circumstances have led to the use of various terms, as respects the *form* and *extent* of the disease, that may briefly be noticed. As regards the *form* or *character* of the malady, when either motion or sensation is entirely lost, the paralysis is *complete* as respects that function; if either be impaired only, or not altogether lost, the disease is *incomplete*. If only one function is affected, the paralysis is *imperfect*: if both sensation and motion are lost, the disease is *perfect*, as suggested by Dr. Bennett. Thus palsy may be not only complete or incomplete, perfect or imperfect; or both complete and perfect, or incomplete and imperfect; but it may even be complete as respects either function, and yet imperfect, inasmuch as only one is lost; or it may be incomplete, and yet perfect as regards the affection of both functions.

4. Palsy has been divided, as respects its *extent*, into *partial* and *general*; the former has been farther divided into *hemiplegia*, when one side or lateral half of the body is affected; *paraplegia*, when the inferior half is attacked; and *local*, when a smaller portion of the frame is affected. It has, moreover, been called *idiopathic* and *symptomatic*; but those who have thus divided it have not pointed out in what its idiopathic nature consists. Palsy is generally, if not universally, a symptomatic malady, inasmuch as it depends upon lesion of the central nervous masses, or of the principal nervous trunks or chords, or of parts implicating them; as it is rarely owing to an affection of the parts themselves which betray the disorder, unless in a few instances of palsy from cold or from some agents directly influencing these parts.

5. Paralysis has been termed *continued* or *intermittent*, *fixed* or *movable*, according as it presents these characters. It has likewise been called *plethoric*, *serous*, *bilious*, *febrile*, &c., according to its presumed cause, or to these states of concomitant disorder. Its origin in certain metallic and vegetable *poisons* has also been used, and with true practical advantage, to distinguish those instances which are thus produced. To these forms and characters of the malady attention will be directed in the sequel, as well as to the *complications* presented by them in practice. In describing the several states and forms of paralysis, *loss of sensation* will be first considered, and afterward the several forms of *loss of motion*.

I. Varieties and States of Palsy.

6. i. Paralysis of Sensation.—*Loss of Sensibility.*—A particular sense, or the feeling of a limited, or even of the greater part of the body, may be impaired or altogether lost—the *palsy of sensation* may be *incomplete* or *complete* in the part affected; the affection being either *limited* or so extended as to be almost *general*. Under the head of *local, limited, or partial loss of sensation*, may be comprised incomplete and complete palsy of the several senses, although some of these affections of sense are treated of in separate articles.

7. *A. Loss of Smell—Anosmia*—is commonly a symptom of some disease, as a catarrh, &c. It is rarely observed as a simple affection, unless it be caused by the abuse of stimulants or of irritants, as of snuff, &c. Dr. Todd and Dr. Good mention instances of this having been a congenital affection. It often attends *coryza*, *ozæna*, nasal *polypi*, diseases of the spongy bones, &c., and it is sometimes caused by external injuries; by prolonged irritation or ulceration of the Schneiderian membrane; and by diseases of, or tumours pressing upon, the olfactory nerves. M. Serres states that disease of the roots of these nerves, and more particularly of the external root, is not an infrequent cause of defect or loss of this sense.

8. *B. Loss of Taste—Ageustia*—sometimes, also, attends other diseases. It occasionally accompanies palsy of the tongue, or of the muscles of the face. It is frequently observed in continued and exanthematous fevers; and is in them, as well as in some other acute diseases, partially caused by the fur and viscid mucus covering the tongue and adjoining parts, that prevents the sapid body from coming into close contact with the nerves of taste. It may be produced also by the use of tobacco, especially by chewing it, or by other acrid substances. It has even arisen from want of exercise of the nerves of taste, as in a case detailed by Dr. Robbins (*Lond. Med. Gazette*, vol. x., p. 175), in which, owing to an unsound tooth, substances were usually taken and masticated in one side of the mouth, without being brought in contact with the side on which the diseased tooth was situated. After the tooth was removed, it was found that taste in that side of the mouth was impaired. A slight degree of ageustia often is associated with loss of smell in severe catarrhs and coryza; and it is then owing chiefly to the state of the nerves of smell and taste. Marked impairment, however, of the former sense often, also, slightly impairs the latter. *Defect or loss of sight and loss of hearing* are fully discussed in the articles Amaurosis and Hearing.

9. *C. Defect or Loss of Feeling.—Absence of the Sense of Touch.—Anæsthesia.—Insensibility of a part, or of the general Surface of the Body.*—Incomplete or complete loss of the sensibility of a part sometimes occurs *alone* or independently of any other form of palsy, but it more frequently *precedes* or *attends* loss of motion, generally of the same part; in rare cases, of another or opposite part. It very rarely *follows* paralysis of motion. It more commonly *precedes* loss of motion of the lower than of the upper extremities; but paralysis of motion is often unattended by loss of sensibility.

10. *a.* The *access* of anæsthesia is often sudden, and without any premonition. Sometimes it is characterized by a perversion, rather than by an absence of feeling; the sensation of fine sand, or of some intermediate substance between the skin and the object touching it, being for some time present, before feeling is lost. In other cases, formications, slight tinglings, and incorrect reports furnished by the sense of touch, precede for a short time more or less complete numbness.

11. The loss of sensibility may be very *partial* in any part of the surface. It may exist in one or more fingers only; and in this partial state may have been *congenital*, or have occurred soon after birth. Partial anæsthesia is observed most frequently in one limb, or in one half of the body, or in one side of the face. In this latter situation, when any substance is put between the lips, the sensation of its being broken is occasioned. Anæsthesia of the surface has been observed by M. Andral in a number of round spots, the surrounding skin being quite sensitive. When loss of sensibility of any of the extremities is considerable, muscular motion of the same extremity is generally more or less impaired. In many cases, however, the defect of the muscular power of the part is caused by the want of report between sensation and voluntary action; for in holding an object in a hand which is deprived of sensibility, it is readily dropped if the eyes are not fixed on it: the sensation of its presence not being conveyed by the nerves of feeling in the part, the act of volition is either imperfectly excited, or is not excited at all. In some such cases, also, it is probable that volition is not transmitted in sufficient force to the muscles to produce prolonged or energetic action. In the familiar instance of numbness from pressure on one of the lower extremities, it will be found that the limb will not support the weight of the body unless volition be strongly exerted.

12. *b.* It is rare to find the sensibility of a part *completely* lost, so that it is insensible to the severest kinds of injury, as to fractures, burns, &c. Cases, however, of this kind have been adduced by Yellowley, Good, Earle, Broughton, and others. It is also rarely observed to be *universal;* although it sometimes commences partially, and extends gradually and generally, until nearly all the surface of the body is implicated. The more extended forms of *partial* anæsthesia generally appear in one half of the body, *hemiplegic anæsthesia*, and is limited with precision by the median line, or in the lower or upper extremities. In these forms it is most frequently followed by, or associated with, loss of motion of the same part. Cases, however, sometimes occur of complete anæsthesia of one side existing without palsy of motion, or with very slight local palsy. In some cases of this kind recorded by Mr. Broughton, there was slight impediment only of speech. In the cases of hemiplegic anæsthesia which I have seen, the temperature of the surface was below that of the sound side, while in hemiplegia, with loss of motion only, the temperature was somewhat higher than that of the opposite side.

13. *c.* The *duration* of anæsthesia is very indeterminate, and depends much upon the remote causes, upon the pathological conditions producing the affection, and upon the treatment. The affection may continue but a short time, as in cases of concussion, or of temporary pressure on a nerve. It may be very protracted, and terminate only with life. The sensibility may be restored unexpectedly, and sometimes even suddenly. When the anæsthesia is associated with loss of motion, it is generally protracted, although it is often removed, while the palsy of motion continues, or is but little relieved.

14. *d.* The *pathological changes* producing anæsthesia are not always obvious: they have even been incorrectly assigned; and it is doubtful whether certain of the localities, which are at the present day supposed to be especially and solely concerned in the propagation of sensation, are really thus exclusively employed. The alteration producing anæsthesia may exist in the brain, in the spinal chord, or in the nerves themselves; but, although the posterior roots of the spinal nerves appear to be more especially concerned in the function of sensation, it has not been fully shown that the posterior columns of the spinal chord are the appropriated channels for the transmission of sensation. Numerous cases are recorded in which the posterior columns have been disorganized, or even the whole chord pressed upon, softened, or otherwise disorganized, and yet the sensibility has either been unimpaired, or even increased. Some of these cases have been referred to by M. Ollivier, and others have been lately published in recent transactions of societies and periodical works. To these a more particular reference will be made in the sequel. I may here, however, briefly remark, that anæsthesia has followed causes affecting chiefly the surface of the body, as the prolonged influence or excessive degree of cold. It has likewise been produced by torpid or interrupted circulation of blood in the part. It is sometimes a symptom in hysteria and hypochondriasis, in all which cases it is usually partial or limited as to extent; and it has occurred in the puerperal states. It has also appeared in connexion with certain epidemics affecting the system generally, and the cutaneous surface and extremities more particularly, as that which prevailed during the summer and autumn of 1828 in Paris: a circumstance calculated to support the view of the pathology of anæsthesia which I shall have to state hereafter.

15. ii. Paralysis of Motion.—*A. The more local and partial states of Palsy.*—Under this head are comprised those varieties of the disease which affect a part only of the body. They are divided, as already noticed, into, 1st. Local paralysis; 2d. Hemiplegia; and, 3d. Paraplegia.

16. *A. Local paralysis* implies loss of motion, or of sensibility, or of both, in some part only of the body, and to a small extent. Although sometimes a permanent state of the disease, it is more frequently the commencement of a more extended malady.

17. *a. Paralysis of motion of particular muscles and parts* is not infrequent, occasioning affections to which certain names have been applied according to their seats. *Strabismus* is often caused by palsy of one or more muscles of the eyeball, although not by this in all cases. *Ptosis*, or falling of the upper eyelid, often arises from an atonic or paralytic state of the *levator palpebræ superioris*, owing to some alteration implicating the nerve which supplies it; although it may arise also from a spasmodic action of the *orbicularis palpebrarum*. A slight examination, or the degree of resistance opposed to raising the eyelid, will immediately show the nature of the affection. Ptosis from local palsy is often associated with squinting, showing that the third pair of nerves is palsied. It is always a serious affection, particularly when thus associated; and is often indicative of cerebral disease, being frequently a precursor of hemiplegia, or even of apoplexy. It is a common and most unfavourable symptom of the advanced stages of diseases of the brain in children. It is, however, sometimes caused by a tumour pressing upon the nerves in some part of their course.

18. *b. Lagophthalmia*, or gaping of the eyelid, the eye being generally open or imperfectly closed, sometimes proceeds from paralysis of the *orbicularis palpebrarum*, owing to disease of, or implicating the *portio dura*. When this is the case, the affection is associated with a state of partial palsy about to be noticed.

19. *c. Palsy of the muscles of the face* is not infrequent, and is generally caused by pressure, injury or disease of the portio dura, and fifth pair of nerves. If loss of motion is complete, the portio dura and motor branches of the fifth pair are affected; if sensibility also be abolished, then the sensitive part of this nerve is implicated. Where the *portio dura* only is paralyzed, there is little evidence of palsy until the muscles supplied by this nerve are called into action. As long as the patient neither speaks nor smiles, the countenance presents nothing remarkable, and the sensibility of the face is unimpaired; but when laughing, coughing, sneezing, crying, or any of the actions of excited respiration are produced, the deformity of the countenance is apparent. The mouth is drawn to the sound side, the derangement of the features being remarkable in proportion to the intensity of the respiratory act. The affected cheek remains motionless, while the other is thrown into unusual action, is flaccid, or swells out at the moment of expiration, or when the patient attempts to pronounce a word with emphasis, and appears broader and more prominent than the sound one, which is more contracted or wrinkled. The muscles moving the jaws, and used in mastication, which are supplied by the motor portion of the fifth, still perform their functions. Owing to the palsy of the lips on the affected side, the labial consonants are imperfectly articulated, and saliva, or even aliments, sometimes escape from the palsied side of the mouth. The patient is unable to spit out his saliva, or to blow fully, or to sniff up with the nostril of the affected side. Lagophthalmia generally accompanies this state of the disease, the eye appearing more prominent, and, being exposed to constant irritation, generally becomes inflamed. In protracted cases the muscles are wasted, and hence the face acquires a peculiar expression.

20. Palsy of the portio dura may be occasioned by severe or protracted cold, or currents of air, giving rise to what was usually termed a blight; but it is probably more frequently caused by an inflamed or enlarged state of the parotid gland, or a tumour in the vicinity of the stylo-mastoid foramen, or inflammation or abscess of the internal ear, or by disease of the petrous portion of the temporal bone, or by a tumour or abscess compressing the nerve at its entrance into the internal auditory foramen; by disease of the brain at the origin of the nerve, or by ulceration implicating the nerve in some part of its course; or, lastly, by a wound or injury of the nerve.

21. When the *motor portion of the fifth pair of nerves* only is palsied, there is generally slight loss of sensibility of the parts supplied by this nerve; but the motions of the jaw on the affected side are impaired. Mastication is impeded, and is not performed on that side, owing to the palsy of the muscles which convey the morsel to the operation of the teeth, and to the lost action of the masseter and temporal muscles. There are still, however, command over the countenance, little or no distortion of the features, and no loss of expression. The jaw is in some cases a little depressed, but this disappears when the patient smiles or laughs, a circumstance distinguishing this variety of palsy from that caused by disease implicating the portio dura. This state of disease may exist alone, but it is commonly associated with loss of sensibility (§ 10, *et seq.*), and is usually farther complicated with hemiplegia. The disease of the motor portion of the fifth pair may be seated in the course of the nerve, or in or near the origin of it in the brain.

22. As Dr. Bennett has very justly remarked, it is rare that the lesions are confined to the fifth or to the seventh pair of nerves. In general, the symptoms of disease of the one and the other are conjoined, although they seldom indicate an equal affection of both nerves. Commonly the disease appears first in the one, and then in the other, and, when the muscles on which the nerves first affected ramify are completely paralyzed, the muscles supplied by the second are partially affected. In some of these cases, also, the paralysis is accompanied with neuralgia of a very acute description. Palsy of either of these nerves is very rarely met with in both sides in the same case. Dr. Abercrombie met with an instance of palsy of the fifth pair on one side of the face, and of the portio dura on the other, occasioned by a tubercle in the brain.

23. *d. Palsy of particular muscles, or of a single limb*, is not uncommon. Temporary palsy is not infrequently produced in these by casual pressure of the nerves supplying them. It may arise, also, from overstraining the nerves, or the muscles themselves, by over-exertion, as by lifting very heavy weights. Dr. Healy has

described instances of palsy of the hand and forearm, owing to pressure caused by the head resting on the arm when asleep, which could be removed only by electricity; and Dr. Darwell has ascribed the palsy consequent upon over-exertion to the injury done to, or over-straining of, the nerves supplying the affected muscle.

24. Palsy of a single limb is not infrequent in children. It is often congenital, and the upper are more liable to it than the lower limbs. It is sometimes owing to congenital disease or deficiency of the brain; but, when it takes place subsequently to birth, it has been imputed to a loaded state of the bowels, or to disorder of the stomach; but disease of the brain or spinal chord is probably more immediately than those connected with its occurrence. Some of these cases grow up, and present the limb of a child joined to the body of an adult. I have met with several instances of this occurrence, one in a physician, another in a medical student, both being characterized by remarkable irritability of temper. An upper extremity, which contrasted remarkably in size with the sound limb, was affected in both these cases.

25. Palsy of a part, or of the whole of one limb, is very generally the commencement of a more extended malady; and instances are sometimes met with where only a few of the muscles of an extremity are affected, these being, according to Sir C. Bell, muscles naturally combined in action, although supplied with different nerves and different blood-vessels. Sometimes all the extensor muscles lose their power, while the flexors preserve it. In rare instances, also, as in the case of a lady lately under my care, the motions necessary for writing, or for any fine work, were completely lost, while the arm could be moved as strongly as ever. It has been supposed that the nerve in these cases is incapable of performing its functions, owing to pressure or disease; and this is probably the case in some instances, as in those recorded by Drs. Abercrombie and Storer, and more especially when partial paralysis follows acute or chronic *neuritis*. It is even possible that, in other cases, the palsy is caused by imperfect or interrupted circulation through the blood-vessels of the limb, owing to disease of them, as supposed by Graves, Stokes, and others. But in some instances there are no indications of disease of the nerve itself, and the circulation is perfect in the affected extremity. In the case of the lady just alluded to, who is about sixty years of age, and of a full habit of body, there was no sign of disease in either the nerves or the blood-vessels of the limb itself. I prescribed for her blood-letting, which was performed under my own eye, twenty-four ounces being quickly taken away without any faintness being caused. After the depletion and purging, the partial state of palsy gradually disappeared.

26. *e. Paralysis of the tongue and muscles of articulation*, although occurring frequently in connexion with hemiplegia and apoplexy, is very rarely met with alone. I have, however, been consulted in several cases, in which it was either the chief part of the disease, or was associated with difficult or impossible deglutition. In a case from the country, which I recently attended, complete loss of the power of articulation was associated with partial palsy of the extremities, the patient being deficient chiefly in the power of contracting the muscles of the hands and forearms. Both lower extremities were also weak. He returned without benefit from treatment, and died soon after. I have not learned the particulars connected with his death. In this case loss of articulation was the first and chief symptom, yet the tongue could be protruded without being drawn to either side.

27. Some years ago, Mr. Winstone consulted me in the case of a professional gentleman, aged about fifty, who had, for many months, lost all power of uttering the most simple articulate sound, and who swallowed substances with the utmost difficulty, or not at all, unless they were conveyed over the base of the tongue. The tongue could not be protruded, and, indeed, was incapable of motion. The mouth, also, could be opened only imperfectly, but the sense of taste was not affected. He had neither headache nor any other ailment, and no other part was paralyzed. He attended regularly to his profession during the usual hours of business, but was obliged to write down all he wished to say. The disease was ascribed to pressure or structural change at the origin, or in the course of the lingual and glosso-pharyngeal nerves; and the prognosis of suddenly fatal apoplexy or general paralysis was hazarded, which occurred some months after my attendance ceased. Various means were prescribed without any effect on the disease.

28. Most frequently, however, paralysis of the muscles engaged in articulation, or in deglutition, or in both functions, follows upon severe or renewed attacks of apoplexy, or of hemiplegia complicated with apoplexy. I have seen it occur after inflammation of the brain, and after cerebral convulsions in children, as in the case of a fine boy, respecting whom I was consulted by my friend Mr. Worthington of Lowestoft. The disease may continue for many months unmitigated by treatment; it is generally ultimately fatal, death taking place after or during a convulsive attack.

29. *f. Aphonia*, in the true sense of the word, can occur only when the *larynx* is affected, either its muscles being paralyzed, or its structure changed by serous or other effusion between its ligaments, tendons, or cartilages. Loss of the power of articulation depends upon paralysis of the tongue, cheeks, and lips; and this loss may be so complete as to prevent all *articulate* sounds from being produced; still the power of uttering sound remains, but in its simplest form only. When articulation is entirely gone, the motions of the muscles of the pharynx and base of the tongue are also lost. Simple aphonia is often caused by temporary inaction or torpor of the nerves of the larynx, in hysterical or nervous persons. Loss of the power of articulation is a much more serious and permanent malady than aphonia, and is either attendant upon, or followed by, the most general or fatal states of palsy, unless in hysterical cases; and in these the motions of the tongue are also sometimes temporarily lost. In catalepsy, voice and articulation are quite lost, with all voluntary motion, but they return as soon as it is restored. In incomplete palsy of the tongue, protrusion of it may generally be

effected; but it is generally drawn to one side, particularly if hemiplegia also exist. In other cases it is usually protruded in a straight direction. The tongue, even in cases of hemiplegia, is not always drawn towards the sound side. Sometimes it is drawn to the paralyzed side. Lallemand imputes its direction to this side to the action of the genio-glossus muscle of the unaffected side drawing the base of the tongue forward, and turning the apex to the opposite side. Cruveilhier attributes the direction of this organ, when protruded, to feebler resistance on one side than on the other.

30. *g. Paralysis of any of the muscles of organic life* rarely takes place to any extent, and is, indeed, incompatible with the continuance of life, unless in those viscera which are particularly influenced by volition, as the urinary bladder, the sphincters, &c. A temporary state of relaxation, or loss of the contractile power, of portions of the alimentary canal not infrequently occurs in the course of various diseases, and constitutes a part of the pathological conditions obtaining in inflammations of this canal, in colic and ileus, in lead colic, in hysteria, &c.; but it rarely continues for any considerable period, at least in a complete form, and in the same portion of the tube, without being followed by a fatal result.

31. *h. Palsy of the urinary bladder*, owing to over-distention, is a frequent occurrence; it is likewise connected with paraplegia, and in both circumstances of the complaint retention of the urine is the prominent phenomenon. Hysterical paralysis of the bladder is often met with. Dr. Todd says that there is much truth in Sir B. Brodie's remark that, in these cases of hysterical paralysis, "it is not that the muscles are incapable of obeying the act of volition, but that the function of volition is suspended." Of course the muscles possess their capability of motion; no one could have suspected the contrary; that the function of volition is suspended in these cases is, however, a more doubtful proposition. The truth is, that a careful inquiry into the phenomena of hysterical paralysis, in some cases which have come before me, has shown that, owing to a weakened or exhausted state of the spinal chord and motor nerves, volition is not transmitted in sufficient force to produce muscular action; and that volition is not suspended, although it may be weakened; but that it must be made with more than usual energy to act upon, or even to be transmitted to the muscles.

32. *i. Palsy*, more or less complete, *of the rectum*, is not infrequent in aged persons, and in hysterical females. In these cases fæcal accumulations often form in the rectum and colon, owing to their inaction or want of power to overcome the resistance of the sphincter.

33. *k. Palsy of the sphincters* of the rectum and bladder attends most maladies in which either the brain or the spinal chord is oppressed, or has lost its power. The inability to retain the fæces, or the incontinence of urine which results, becomes one of the most troublesome and unfavourable phenomena of the disease. As, however, this form of local paralysis very rarely occurs unconnected with a more extensive malady, it will be more fully noticed hereafter.

34. *B. Hemiplegia* (from ἥμισυ, *the half*, and πλήσσω, *I strike*)—*semisideratio*—is used to denote paralysis of one side, extending to both the upper and the lower extremities. When the upper limb of one side and the lower of the opposite side are affected, the palsy is usually called *transverse* or *crossed palsy*; but this form is comparatively rare. Hemiplegia is the most common form of the malady; and it occurs more frequently on the left than on the right side, the proportion being as three to two, according to the observations of Sir G. Blane. Generally the paralysis extends to the side of the face, the angle of the mouth being drawn to the sound side, and a little upward; the tongue, also, is often more or less affected, and on the same side, as shown either by its imperfect protrusion, or by its being drawn to one side—usually to the same side as the mouth. The pharyngeal muscles are sometimes also affected. Hemiplegia is limited exactly to one half of the body, the median line being the boundary, owing to the distribution of the spinal nerves.

35. The attack of hemiplegia occurs variously. 1st. It may appear gradually; local palsy, affecting first the fingers or toes, leg or hand, taking place, and extending slowly and gradually until the lateral half of the body is implicated. In some cases of this form of the disease, convulsive movements of a limb, or even of both limbs, are remarked, and continue until the loss of motion is complete.

36. 2d. After various chronic cerebral symptoms, and affection of one or more of the senses, the speech becomes affected, the tongue more or less palsied, or protruded with difficulty, and the face distorted; upon these complete hemiplegia supervenes in a short period. This form is not infrequent in aged persons. In this and the preceding variety, several organic lesions, as tumours, tubercles of the brain, or its membranes, are often present.

37. 3d. After cerebral symptoms of a more acute and painful character; after severe headache, febrile commotion, sometimes delirium or intelleetual disorder, spasm or twitchings of the muscles, pain in the limbs, occasionally spastic rigidity of some of the flexor muscles, or even convulsions, complete hemiplegia takes place. In this variety inflammatory softening of a portion of the brain is often present, and pain is complained of in the paralyzed limbs.

38. 4th. After injury of the head, at a more or less remote period, or after chronic cerebral symptoms, and various affections of some one or more of the senses, convulsions or epileptic seizures occur, which, after a more or less frequent recurrence, are followed by palsy of a limb, most frequently the arm, extending to the whole side; or at once by complete hemiplegia. In three cases of this variety I found one or more abscesses in the brain. In these several states of hemiplegia the sensibility is generally unimpaired, or but partially affected.

39. 5th. Hemiplegia may occur suddenly, without any previous indication. In some of these cases I have ascertained the existence of inflammatory attacks of the brain at a remote period, recovery having taken place long previously to the hemiplegic seizure. This variety is often followed by *apoplexy*, but at no precise period.

40. 6th. Hemiplegia frequently immediately follows an *apoplectic seizure*, or attends it, or appears in its course. In this variety more especially, and very often in that immediately preceding, hæmorrhage within the cranium has occurred. Generally the hemiplegia is observed only when the stupor subsides; but in many instances it may be detected at first by a careful examination of the state of the extremities and features. According to my experience, the sensibility is most frequently implicated in the fifth and sixth of these varieties of the seizure.

41. Although some reference has just now been made to the cerebral lesions upon which those varieties of hemiplegia individually appear most frequently to depend, still no precise or constant connexion between the one and the other has been ascertained, and most probably it does not exist. Nevertheless, the relation is too frequent and too obvious to be entirely overlooked. Of hemiplegia it may be remarked, in general terms, that it may proceed from any one or more of the numerous organic lesions which are described in the articles on the morbid anatomy of the Brain and its Membranes, and of the Cranium. (*See these articles.*)

42. One fact may be relied on, viz., that the lesion exists, with very few exceptions, and these not very precisely determined, in the side of the brain opposite to the seat of palsy. Dr. R. B. Todd remarks that, according to the views of Foville and others, we should expect to find the optic thalami and corpora striata, or some of the fibrous radiations which pass through these bodies, the seat of disease in hemiplegia; and, in fact, in the generality of cases, those bodies, or some portion of the cerebral hemisphere, present alteration of structure, variable in extent as well as in degree. It must be admitted, however, that cases occur in which one only of these bodies is the seat of disease, or in which no appreciable lesion can be detected in the hemisphere. Such occurrences, however, as Dr. Todd justly observes, can hardly be deemed to militate against the theory of Foville, inasmuch as our ignorance of the mechanism of cerebral action, whether healthy or morbid, is alone sufficient to make them appear anomalous to us.

43. Hemiplegia is very rarely produced by disease of the upper part of the spinal marrow. In several cases of lesion of this part, in which I have been consulted, the paralysis has been at first local or partial, generally affecting one arm, but it has soon become more general. In some instances, however, one side has been affected more than the other, or one or two limbs more than the rest. Instances, however, have been observed of loss of motion on one side, and anæsthesia of the other; but these are remarkably rare. One has been adduced by Portal, and another by Mr. Dundas. This latter case was consequent upon concussion of the spine produced by a fall. The temperature of the side and limbs, deprived of sensation, but possessing muscular power, was $1\frac{1}{2}°$ Reaumur, below the side which retained sensation without motion, the heat on this side being rather beyond natural, and the sense of feeling morbidly increased.

44. Hemiplegia may be *congenital*, or may occur soon after birth. M. Cazauvieilh has shown that congenital hemiplegia usually depends upon an arrest or defect of development or growth in a portion of the brain. The limbs of the affected side, particularly the arm, were stunted in growth, and flexed and contracted. The opposite hemisphere of the brain was generally smaller, the convolutions imperfectly developed, the capacity of the ventricle less, and the corpus striatum and optic thalamus of smaller size. Cases of this kind may attain an advanced age. Most of the instances I have had an opportunity of observing were idiotic, as well as incompletely paralyzed on the deformed side. Cases of hemiplegia have occurred in which the opposite side has become similarly affected, either soon after the first attack, or during convalescence from it. In these the sensibility has sometimes either been only partially, or not at all affected.

45. The paralyzed side may be the subject of *pain*, the result of morbid action in the brain, or of *spasm*; hence designated spasmodic hemiplegia by Sauvages and others. In these, inflammatory irritation in the brain or its membranes, in the vicinity of the primary seat of lesion, often exists. Deep-seated pain or spasm may occur in a limb, the superficial sensibility of which is either impaired or altogether lost; and either or both phenomena may affect the opposite or sound limb, although less frequently than the paralyzed side. I have never seen an instance of hemiplegia with spasm of the paralyzed side, to which the term of *hysterical*, imposed by some nosologists, was strictly applicable. Hysteria very rarely occasions true or complete hemiplegia, but I have met with several cases of paraplegia caused by hysteria.

46. *Intermittent hemiplegia* has been noticed by Sauvages, Morgagni, Cullen, Elliotson, and Todd; but examples of it have been rarely and imperfectly observed. It would seem that the congestion of, or vascular determination to, the brain, during the febrile paroxysm, occasioned a condition of one of the hemispheres, or of a portion of it, so as to interrupt the action of volition; but that the change was only temporary, and depended upon the state of circulation attending the febrile paroxysm; that it consisted neither of softening nor of hæmorrhage.

47. Much variety in the symptoms are observed in the course of hemiplegia, depending upon circumstances that will be alluded to hereafter, and upon a partial or more complete return of sensibility when this has been also lost, and upon a slight recovery of some of the motions of the limbs, particularly of the lower limb; but generally when the patient is able to walk a little, or with the aid of a stick, the lower extremity is usually thrown forward by the inclination of the trunk to the sound side. The foot is pointed outward when the limb is raised, and falls from its own gravity. The affected arm is applied to the trunk, and the forearm is slightly flexed on the arm, the wrist and fingers being also slightly bent inward, and occasionally somewhat œdematous.

48. *C. Paraplegia* (from παρὰ, *vitiose*, and πλήσσω, *percutio*) has in modern times been applied to that form of palsy in which the lower half of the body is deprived of motion or sensation, or of both. Hippocrates denominated all paralytic affections paraplegia which

were consequent upon apoplexy; and Aretæus employed the word to designate any form of palsy. Boerhaave and Van Swieten defined paraplegia to be a palsy of all parts below the neck, or viewed it as a *general palsy* (§ 65, *et seq.*); and in this sense it has been used by Ollivier and several modern pathologists. I shall, however, apply the term *paraplegia* to that form of palsy which affects the lower half of the body on both sides. When palsy extends to the upper and lower extremities of both sides, it may be denominated, although it is not strictly, *general palsy*.

49. The symptoms most characteristic of *paraplegia* are, *loss of the power of motion in the lower limbs, with inaction of the urinary bladder and rectum, with loss of power over the sphincters, and often with impairment or entire loss of sensation.*

50. The *accession* of the symptoms of paraplegia, as well as the character, range, and grouping of the symptoms themselves, varies with the pathological changes or physical causes of the malady, as it proceeds from injury, from inflammation and its consequences in the spinal chord or its membranes, or from organic lesions of these parts, or of the bones and cartilages of the spine. When the disease is consequent upon injury, the symptoms are generally sudden in their accession and fully developed, although this is not always the case, especially if the accident be slight, and serious only as regards its consequences. When it proceeds from disease of the chord or of its envelopes, some disorder of sensation or of motion, or even of both, is first experienced, which becomes more or less rapidly increased to numbness, or diminished power of motion, of the lower extremities. The patient trips when walking, is unable to stand for any time, and complains of a sense of weight in the limbs, and of pains extending to the legs and feet. He cannot walk without the aid of one or two sticks, or of another person. The urinary bladder, rectum, and sphincters soon afterward become more or less affected, and various other phenomena supervene, according to the seat and extent of the organic change occasioning the affection. In some cases *sensibility* in the lower extremities is but slightly, or even not at all impaired, particularly when the lesion is seated high in the spine; and when this is the case, even the patient's power over the excretions and the sphincters may not be materially impaired. It is comparatively rare that sensibility is impaired or altogether lost in the lower limbs without the power of motion being also diminished or abolished.

51. *a.* The *symptoms*, *progress*, and *consequences* or *terminations* of paraplegia vary with the lesion producing it; and it is difficult, if not impossible, to connect the symptoms, in their full extent and course, with the particular lesion upon which they depend. The exact seat of lesion, in respect not only to the portion of the chord which it affects, but also to the roots of the nerves connected with the part implicated; the nature of the lesion, particularly as regards the degree of pressure, or of irritation, it produces; and the suddenness or slow progress of the change, all influence very remarkably the phenomena and course of the malady.

52. There are few diseases which have been more lucidly illustrated than paraplegia consequent upon injury has been in the admirable paper upon the subject published by Sir B. C. Brodie; and as injury often causes inflammation and its usual consequences of the spinal chord and its membranes, the subject has both a medical and surgical bearing. Many, however, of the changes consequent upon injury—even hæmorrhage upon or into, and softening of, the spinal chord—and various organic lesions of these parts or in their vicinity, may occur independently of external injury, and cause paraplegia. It will be proper to enumerate these.

53. [1]*a. Concussion* of the spinal chord affecting the intimate structure of some part of the chord, although not evidently to the unassisted eye; [2]*b. Manifest laceration* or *division* of its substance; [3]*c.* The *pressure* or *irritation* caused by *extravasated blood;* [4]*d.* The pressure or irritation produced by *displaced bone;* [5]*e. Sanguineous congestion*, particularly of the spinal veins or sinuses; [6]*f.* The usual *consequences of inflammation* of the chord or of its membranes, especially effusion of coagulable lymph, induration of the substance of the chord, &c.; [7]*g. Softening* of the chord, whether it be consequent upon inflammation, or upon impaired nutrition or lost vitality; [8]*h. Inflammation* and its *consequences of the vertebræ*, or of the intervertebral substance, as *caries*, *exostosis*, *anchylosis*, *&c.*, *of the vertebræ;* [9]*i. Scrofulous disease* and *tubercles* in these parts; [10]*k. Tubercles* or *tumours in the chord* or its membranes; [11]*l. Hydatids* in either of these situations; [12]*m.* And *fungoid* or *malignant tumours* implicating the chord or the roots of the spinal nerves, are severally pathological causes of paraplegia; but the symptoms of individual cases, as well as the issue, depend upon the part of the chord affected; upon the extent of the particular lesion; upon the slowness or rapidity of its development; and upon the manner in which the chord or roots of the spinal nerves is implicated, whether by pressure, loss of substance, softening, irritation, interrupted circulation, &c., or by two or more of these conjoined.

54. It would be inconsistent with a proper consideration of this subject were I to overlook the physical condition of the spinal chord, especially in relation to the fluid surrounding it, to the membranes enveloping it, and the bony case protecting it. The physiological view here suggested materially aids the pathological consideration of the subject. This interesting physical condition also obviously concerns the roots of the spinal nerves, and serves to explain several circumstances connected with them, as well as with the spinal chord itself. These parts, being thus surrounded by a limpid fluid, and being protected by membranous coverings, and by a bony case and muscles, are thereby rendered much less liable to disease and injury than if they were otherwise circumstanced, as first insisted upon by Cotugno, more recently by Magendie, and most satisfactorily by Dr. Todd. Before pursuing farther this part of the pathological bearing of the subject, I will notice more fully the chief phenomena of paraplegia.

55. *b. Paralysis of motion* is the chief characteristic symptom of paraplegia, and it affects more or less all the muscles supplied with nerves from the seat of, and below, the injury or disease in the chord. If the disease be slight,

only one limb, or a set of muscles, may be affected, as above adverted to, especially if the roots of a nerve or nerves on one side only he implicated; or one limb may be more severely affected than the other; or a slight affection may soon become severe, or the converse. Complete paraplegia may thus be gradual and slow, or it may be sudden. It rarely happens that the palsy extends to parts supplied with nerves proceeding from a portion of the chord above the seat of injury. Instances, however, of this occurrence are recorded by Mr. Stafford and Sir B. Brodie. In these cases, it may be presumed that the consequences of the injury, as softening of the chord, effusion of blood or of lymph, had extended upward from the part primarily injured.

56. Although voluntary motion is completely abolished in the lower limbs, involuntary motions and spasms of their muscles are not infrequent. When the lesion is seated high in the chord, spasmodic contractions, either of more or less permanency, or of a momentary or short continuance, may affect the abdominal muscles, as well as the muscles of the lower limbs, and these may be attended by much or by little pain, either in some portion of the spine or in the limbs. Occasionally the involuntary motions are of a tremulous kind, and often the flexor muscles are those more permanently contracted. The pains, involuntary motions, and spasms are manifestly caused by inflammation or irritation of the chord or of its membranes, or of the roots of the nerves at the seat of lesion, especially by extravasated blood; by pressure or irritation of tumours, displaced bone, effused pus; by caries of the vertebræ, by malignant or other formations.

57. *c.* The *affection of the urinary organs* consequent upon paraplegia from injury or disease of the spinal chord varies in different cases. It may be considered with reference to the functions of the kidneys and the states of the bladder. Paraplegia from severe external injury is very frequently followed by diminished secretion of urine, or even by complete cessation of the function; but this is often only temporary, and the urine is secreted in variable quantity and altered quality. In some cases, it is at first acid, very offensive, of a yellowish colour, and deposites a yellow, amorphous sediment. More commonly, however, especially after two or three days, the urine is ammoniacal and turbid when voided, and deposites on cooling a quantity of adhesive mucus. At a later period a white substance, phosphate of lime, may be detected in the mucus, which is often tinged with blood; and subsequently blood and bloody coagula are blended in the urine and mucus. These changes generally take place between the third and ninth days from the paraplegic attack, when it is sudden and complete, especially if caused by injury, and when the bladder becomes distended from loss of its contractile power. At the same time that this distention exists, a dribbling of urine often takes place, if the fluid is not drawn off. In other cases, especially in those caused by disease seated in, or implicating, the chord, the voluntary power over the sphincter of the bladder only is paralyzed, there being incontinence, but no retention of urine. In the most severe cases, the urinary affection continues and hastens a fatal issue; but in others, the power of evacuating the bladder, or of retaining the urine, is restored; and the urine assumes a more acid and healthier character. This amelioration of the urinary disturbance is one of the chief indications of restoration of the functions of the chord; but the state of the urine often varies from time to time, before it becomes permanently healthy, or before the muscles of the extremities obey the will.

58. In these cases, where the urinary bladder is paralyzed, and the urine retained, a state of septic or asthenic inflammation is rapidly produced in the mucous membrane of the bladder, ureters, and pelves of the kidneys, occasioning the chief changes observed in the urine, particularly the ammoniacal state, the presence of mucus and coagula of blood, &c. Sir B. Brodie has put the question, whether the injury of the chord operates directly on the mucous membrane, or whether its first effect is to alter the quality of the urine, the mucous membrane becoming affected afterward, owing to the unhealthy and irritating secretion? Instead, however, of imputing the effect on the urinary organs to one of these causes only, I believe that it may be justly imputed to both of them: that the unhealthy and irritating secretion rapidly induces inflammation of the surfaces with which it remains for a time in contact, owing to the marked disposition of these surfaces to become inflamed when deprived of that portion of nervous influence which they derive from the spinal chord; and that they partake in this disposition to be inflamed and ulcerated with other parts below the seat of spinal lesion. In some instances, particularly when the lesion is seated high in the chord, or when the paraplegia is incomplete, or the power of motion principally affected, the urinary disturbance is not considerable, and the powers of expulsion and retention but little impaired.

59. *d.* The *bowels* are generally not only torpid in paraplegia, but the evacuations are very dark and morbid. This latter state is the more remarkable, the higher in the chord is the seat of lesion. In a case lately under my care, the evacuations, which were procured with difficulty, were nearly black, or of a deep greenish black, and of a treacle or tar-like appearance and consistence. This colour is probably owing to impaired decarbonization of the blood by respiration, the liver and digestive mucous surface performing a vicariously increased function in respect of sanguineous depuration, or of removing the superabundant carbon from the blood. This explanation of the phenomenon was published by me as early as 1815, and subsequent observations induce me to reassert it now.

60. One of the earliest phenomena associated with paraplegia is palsy or *inaction of the rectum and colon*, the latter viscus especially being unable to propel its contents. At the same time, the sphincter ani is not relaxed, but subsequently, or as soon as the fæcal matters accumulate in the lower bowels, they pass involuntarily, owing to reaction of these bowels on their contents, and the loss of voluntary power over the sphincter. Incontinence of the fæces generally accompanies retention or incontinence of the urine; while, on the other hand, it is not remarked in the same states of the

disease that are unattended by the urinary disturbance (§ 57). Still, although the patient has power over the fæcal evacuations, particularly when the upper portion of the chord is affected, or when paraplegia is consequent upon disease slowly developed and implicating the chord, the stools are not the less black and offensive. They are often also very abundant, and the intestines are usually distended by gases, and are tympanitic.

61. *e.* The *sensibility* in paraplegia varies remarkably. When the palsy is caused by concussion or other severe injury of the chord, both sensation and motion are abolished. In slighter cases, and in diseases or spontaneous lesions implicating the chord, and occurring gradually and slowly, the sensibility may be unaffected, while motion is altogether lost. In other cases, sensation may be only blunted, or it may be impaired in one part, and perfect in another, or entirely lost. Very frequently sensibility of the surface only is impaired or abolished, while deep-seated parts retain their sensibility; and often pains, more or less acute, or feelings of heat, burning, or constriction, are felt in the back, abdomen, or loins; or even in limbs or parts which are altogether insensible to touch, and even to external punctures or injuries. Sensation is sometimes gradually, occasionally suddenly, lost; but, as in hemiplegia, so in paraplegia, it is restored before the power of motion.

62. *f. Priapism* attends paraplegia from concussion or injury of the upper portions of the chord; but it sometimes occurs in those cases which are caused by disease. Sir B. Brodie has not met with this symptom where the seat of lesion was below the sixth dorsal vertebra. It is observed even where the sensibility is altogether abolished. It seems to be occasioned, in some cases, by the irritation consequent upon the introduction of the catheter.

63. *g.* The *temperature* of the paralyzed parts is generally above the healthy standard. This is most manifest in complete paraplegia from external injury; but I have observed it also increased in cases produced by disease, although not so generally and remarkably, and where the sensibility of the surface was unimpaired. This increase of temperature appears to be chiefly owing to the dry and unperspiring state of the surface of the paralyzed parts, in connexion with the state of the circulation and blood.

64. *h.* The occurrence of *gangrenous sores*, upon the least injury or pressure of any of the paralyzed parts, is generally observed, and is often remarkable. It seems to be attributable to an impaired vital cohesion of the tissues, caused by a loss of that portion of nervous energy bestowed on them by the spinal chord It is most manifest in cases of severe injury of the chord, and when sensibility is altogether lost. When the lesion is seated high in the chord, and is more or less chronic, a scurfy, dry, or furfuraceous state of the surface is often observed.

65. *D.* General Paralysis.—When palsy extends to both sides of the whole body—when all the limbs and trunk of the body are deprived of motion—the disease has usually been viewed as *general palsy*. In this very extended form of the malady voluntary motion may alone be lost, sensibility still remaining. But the general sensibility is sometimes also more or less impaired, as in cases of paraplegia, much more rarely altogether abolished. Indeed, general palsy may be viewed as a more extended state of paraplegia, as it has been by some of the older as well as of more modern writers. In some rare instances the senses, or one or more of them, have been impaired, or even lost, as well as the power of motion and sensation. Instances of this kind have been published by M. Defermon and Mr. Davies Gilbert. In the more common states of general palsy the affection extends no higher than the upper extremities, and depends upon some lesion implicating the spinal chord or its membranes below the origin of the pneumogastric nerves. In the rare instances, where the senses are also implicated, the lesion is generally seated within the cranium, or in one or more of the parts composing the base of the brain. In the case described by Mr. D. Gilbert, it was found, upon dissection, that "the dura mater lining the basis cranii was deficient, and its place occupied by a thin and transparent membrane, loosely and singularly arranged; the tentorium cerebelli was likewise deficient, so that the posterior lobe of the brain rested immediately upon the upper surface of the cerebellum. All the nerves were regular."

66. *a. Concussion of the brain* and the *more severe states of apoplexy* are attended by general palsy, concussion of the brain especially implicating also the senses. These, however, occur differently, and are attended by phenomena which remove them from the category of paralytic diseases. The relation between them, however, is intimate. Motion, sensation, and consciousness are all lost in these maladies, respiration and circulation alone continuing. As soon as the respiratory nerves are affected by direct or counter-pressure in apoplexy, or by the change produced in the intimate structure of the brain, or medulla oblongata in concussion, life is soon terminated. When, on the other hand, the mischief is less extensive, and the patient regains consciousness, a more or less general state of palsy may remain, at least for a time, and either recovery take place, or hemiplegia, or more partial palsy, only remain. The *apoplectic* or *cerebral form* of general palsy may be viewed as an indication merely of the nature and extent of the cerebral lesion. A person may be seized with hemiplegia consequent upon softening of a portion of one of the hemispheres, or upon hæmorrhage in the brain, or upon any other organic lesion. A greater amount of the same lesion, or others concurring with it, may so completely subvert the powers of motion, and even of sensation, as to give rise to a general palsy, circulation and respiration alone remaining. These occurrences are not rare. Thus, inflammation, limited to a portion of the brain, may first occur, and be manifested by symptoms which the close observer will detect. At an indefinite period subsequent to this attack, the patient may be suddenly seized with hemiplegia, and may continue in this state for weeks, months, or even years, when a profound apoplectic seizure occurs, occasioning general palsy, extending ultimately to the muscles of respiration, and causing death by asphyxia. But in rare in-

stances, instead of an apoplectic seizure, the other side may become palsied, as respects the power either of motion or sensation, or of both, and either before or after the side first affected has recovered any, or much of its powers. In this case there is general palsy, incomplete, probably, as regards one or other function in either side, with certain of the senses and many of the faculties of the brain but little affected, until apoplectic coma or paralysis of the muscles of respiration terminates life. An instance of this kind recently occurred in the practice of my friend Dr. Babington, and upon dissection lesions were found in both hemispheres of the brain.

67. *b.* The forms of general palsy to which I am most desirous of directing attention are altogether *spinal*. They may occur *suddenly*, as in cerebral general palsy, or *gradually*, and even slowly. Severe injuries, as dislocation of the cervical vertebræ, laceration of the chord, violent concussion of the spine, hæmorrhage upon the cervical portion of the chord, &c., usually occasion general palsy instantly; but disease seated in the spinal chord or its membranes, or implicating these consecutively, produces the paralytic phenomena much more slowly. Even severe injuries may not be followed by palsy for a considerable period; still it may be stated that the accession of general palsy from injury, as well as the phenomena characterizing it, will vary with the immediate or more remote effects of the injury upon the chord or its membranes, it being either instantaneous or remote, according to the extent and nature of the lesion produced. A muscular man, aged about sixty years, the father of a late medical friend, when turning in bed, his head being forcibly pressed on the pillow, so as to partially raise the trunk, felt something snap in his neck. He was afterward unable to bend or to rotate the head without causing much pain in the neck. I inferred that rupture or laceration of some of the small muscles or ligaments had occurred, and advised quietude and various means which palliate the more painful symptoms. Still the least movement of the head caused distress. Notwithstanding this, he travelled outside a coach, during the summer, to Cornwall, and returned to town, and not till sixteen months after the accident he complained of numbness and want of power in the left arm. In a day or two the palsy extended to both the upper extremities, but was incomplete in the right; it soon became more general, and in a short time difficulty of breathing, rapidly terminating in asphyxia, supervened. The body was examined by Professor R. Quain and myself, and the second cervical vertebra was found fractured completely across on both sides, the fracture on one side passing close to the base of the odontoid process. Chronic inflammation had extended from the fracture to the theca and membranes of the medulla oblongata; lymph was thrown out upon the arachnoid surfaces; the membranes, particularly the dura mater, were much thickened, and ultimately the chord at this part was pressed upon.

68. Next to injury or concussion of the spinal chord, *caries* of one or more of the cervical vertebræ may be considered as a cause of general palsy; but the palsy rarely occurs until the disease of the vertebræ has induced chronic inflammation of the membranes of the chord, with thickening and effusion of lymph, or such a degree of angular curvature as to affect the physical condition of the chord itself. I was lately consulted in the case of a child, twelve years of age, who presented unequivocal indications of caries of one or two of the cervical vertebræ consequent upon malignant scarlatina. To these supervened incomplete palsy of motion in one arm and hand, which gradually increased and extended to the other arm and lower extremities, until general and complete palsy of motion existed; sensibility was unimpaired. The bowels were obstinately constipated, and the evacuations black and tar-like. The sphincters were not paralyzed. Respiration was performed by the diaphragm, and all parts below the face were deprived of motion. The head could neither be rotated nor bent without great pain. The body and limbs were much emaciated. The skin was cool and dry, and covered with a furfuraceous scurf, particularly the scalp. The pulse was very frequent, weak, and soft; the tongue furred and loaded. After persisting for many months in a treatment hereafter to be described, this young lady recovered the use of her limbs, the neck, however, remaining stiff, shortened, and turned a little to one side. In this case, the change produced in the membranes enveloping the chord, or in the theca, was most probably limited to the diseased vertebræ and their immediate vicinity. It is not unlikely owing to this limitation of the disease, and to the gradual accession and increase of it, that the sphincters continued unaffected.

69. *c.* General palsy may be only an *extension of paraplegia*, or, in other words, the disease may commence and continue for a time as paraplegia, either complete or incomplete, and gradually extend higher and higher until the trunk and upper extremities are deprived of motion, sensibility being generally either not at all or but little impaired. In some of these cases, the palsy of the lower extremities, as well as that consecutively affecting the upper parts of the body, continues incomplete for a long time, the motions consequent upon volition being imperfect, weak, and vacillating, and executed slowly, tremulously, and with difficulty. In these the patient often complains of spasmodic or severe pains in the limbs, with a sense of constriction; of spasm and flatulent distention, with occasional attacks of painful constriction in the abdomen; of want of power over the sphincters, and involuntary discharges. This last symptom often varies much in different cases and different times in the same case, according to the treatment, &c.

70. In other cases, the paralytic symptoms either appear nearly cotemporaneously in several parts or limbs, soon becoming general or more complete, or extend much more rapidly from the lower to the upper extremities, than in the immediately preceding class of cases. Still the same symptoms are generally present, only varying in some subordinate phenomena, sometimes continuing nearly stationary for months or even for years, and ultimately terminating in a similar manner. I occasionally attended, during nine or ten years, a gentleman somewhat above the middle age, who was

affected with this particular form of general palsy. It was long incomplete, sensibility being but little impaired, even when the power of motion was altogether lost. Power over the sphincters was only partially retained for some years, but was very considerably increased by opiates, conjoined with stimulants and aromatics; at last it was altogether lost. The intellectual powers were unimpaired. Ultimately cerebral symptoms, followed by coma and death, supervened. Permission to examine the body was allowed by his accomplished and highly intelligent relatives. The membranes at the base of the brain were more vascular than usual, and a considerable quantity of serum was effused. All the spinal arachnoid presented appearances of previous chronic inflammation. It was thickened, covered in parts with false membrane, or adherent to the opposite surfaces by means of cellular bands. The whole dura mater, or sheath of the chord, was more or less thickened throughout, and the arachnoid of the chord, where it was not adherent, was opaque and thickened. The venous sinuses, placed between the bodies of the vertebræ and the sheath of the chord, were remarkably dilated and congested, so as manifestly to encroach upon the spinal canal and diminish its calibre, especially at the lowest part of the chord. The chord itself was firmer than usual, particularly in this situation, was somewhat atrophied, and its gray substance was wasted and less apparent. Its vascularity also was diminished, although the spinal veins and sinuses external to the sheath were remarkably diluted, and congested with coagulated blood.

71. While I was treating the above case, a respectable tradesman, aged about fifty, came under my care, and was seen by me occasionally until his death, which took place three or four years afterward. The symptoms, protracted course, and termination of the disease, were altogether the same as those just described. On examination after death, the lesions found in the spinal chord were also similar to those observed in the preceding case. The chief difference was the less remarkable congestion of the spinal veins or sinuses, although this was considerable. The consequences of the chronic inflammation of the membranes, and the state of the chord itself, were nearly the same as those already described. There was, however, a more abundant effusion of serum between the membranes of the chord than in the former case; and much fluid was found in the ventricles of the brain. The upper portion of the medulla oblongata, and the membranes at the base of the brain, presented appearances of recent acute inflammatory action, especially increased vascularity and congestion, with a turbid serous effusion: these corresponded with the cerebral symptoms preceding death.

72. I have occasionally seen, during the last few years, with Mr. Pettigrew, a gentleman between thirty and forty years of age, whose complaints are nearly the same as those characterizing the above cases, and are most probably owing to similar changes existing in the spinal chord and its membranes. In this case the loss of power over the sphincters is more remarkable than in the preceding cases, or, rather, appeared earlier in the course of the disease.

73. The above cases of general palsy from *chronic inflammation of the membranes of the chord and its consequences* came before me when the paralytic symptoms were more or less fully developed. I had an opportunity, many years ago, of observing the disease from its commencement. In 1820, a boy, aged thirteen, was brought to my house with chorea. He had rheumatism of the arms and wrists, associated with rheumatic pericarditis. After a few days the rheumatic affection subsided, and the chorea returned, with pain in the course of the spine. Leeches, &c., were applied along the spine; but the disease passed into a state of general palsy, which was complete in respect only of motion, from the head downward. All power over the sphincters was lost; sensibility of the surface was at first acute, and, although it became somewhat impaired as the general palsy was developed, still it was not materially diminished. After death, coagulated lymph and turbid serum were found effused between the opposite surfaces of the arachnoid of the chord in a very remarkable quantity, and so as to press upon the chord itself. (See *Lond. Med. Repos.*, vol. xv.)

74. *d.* It has been stated above (§ 52, 53) that *softening of the spinal chord*, whether it be the consequence of concussion of the spine, of inflammatory action, or of some other morbid condition of the vessels, or constituent tissues of the chord, is not an infrequent cause of paraplegia when seated in any portion of the chord below the fourth or fifth cervical vertebra. When the disease is seated at or above this part, the palsy is nearly general. In a very remarkable case recorded by Dr. Webster, the spinal chord was soft and pulpy in this situation, particularly the posterior columns; the membranes were adherent to the chord; close to the softened part the medulla was of a dusky red tinge, but above and below this part it was healthy. The subject of this case "was for many months totally unable to move, even in the slightest degree, any muscle situated lower than the neck, but still retained the capability of feeling quite perfect throughout the surface of the body; while the other senses and intellectual faculties were unimpaired to the last moment of his existence. Indeed, the patient's cuticular sensibility even appeared, in the latter stages of the case, to be more acute than natural." The evacuations took place involuntarily, and violent spasmodic twitchings frequently affected the lower extremities.

75. *e.* Although general palsy as well as paraplegia is most generally caused by some manifest lesion seated in, or implicating the spinal chord or its membranes, when the functions of the brain are unimpaired, still it is not to be inferred that the lesion is always of a nature which may be detected. Cases sometimes occur that present no appreciable lesion, at least to the unaided eye, upon dissection; and others recover after a treatment not obviously calculated to remove any serious lesion of the chord or its membranes. Sir B. Brodie refers to a case (*Lancet*, No. 1060, p. 380) which commenced as paraplegia and terminated in general paralysis. The spinal chord and solar plexus were examined with the greatest care after death; but they presented no change from the natural state. Sir B. Brodie justly

remarks, that it is not, however, to be supposed that this is a mere functional disease because we see no lesion after death. The minute organization of the brain and spinal marrow is not visible to the naked eye, and even with the microscope we can trace it only a little way. Some defect in the minute organization, some change of structure not perceptible to our senses, may exist in the part and interrupt its functions.

76. Some years ago I attended, with my friend Dr. Roscoe, a gentleman who had resided many years in an intertropical country. On his voyage across the Atlantic to this country, in the winter season, he was seized with general palsy of the powers of voluntary motion immediately after prolonged exposure to cold and wet. The functions of the brain were unaffected; and neither pain nor uneasiness was felt in the neck or in any part of the spinal column under any circumstances of position, flexure, rotation, or pressure. No evidence of inflammatory action or of congestion in the spine could be detected. Cutaneous transpiration was suppressed, and the bowels were costive and torpid; but he retained the sensibility of the surface, and command over the sphincters. He was treated, at first, upon the supposition of either serous effusion or vascular congestion having taken place in the spinal canal, but without receiving any benefit. He ultimately, however, quite recovered by having a frequent recourse to warm baths containing stimulating substances.

77. That form or state of general palsy in which structural lesion may be inferred to be most decidedly absent, and which consists entirely of functional disorder, is the *cataleptic seizure*. In this affection, as shown elsewhere (*see art.* Catalepsy), voluntary motion is altogether suspended; but in two very remarkable cases, which I had an opportunity of observing attentively, consciousness and sensibility remained, with the senses of seeing and hearing. Yet no part—neither the muscles of the tongue or jaw, nor the eyelids—could be moved during the attacks, which often continued for many hours; nor did the least muscular contraction take place on tickling the soles of the feet, or on pinching any part, although the sensibility was affected by these acts. Recovery from these seizures was generally sudden and complete, little disturbance beyond slight hysterical disorder on some occasions being observed.

78. *f. The symptoms of general palsy* vary much with the lesion occasioning it.—*a.* The *accession* of the attack also varies. In the *cerebral form* of the malady, particularly when it depends upon *apoplectic* or *epileptic seizures*, and when it assumes the cataleptic form, the accession is sudden or rapid. In the *spinal form* the symptoms appear gradually, and generally slowly, when it is the result of disease, but often suddenly and completely when it proceeds from severe injury. In the cerebral state, the *sensibility*, and even consciousness, are abolished or nearly lost; but in the *spinal states* (§ 67, *et seq.*) of the malady, sensibility, the functions of sense, and the intellectual powers are either unimpaired or but little affected. In a few cases only is the sensibility of the general surface remarkably diminished, and in still fewer is it altogether lost.

79. *β.* The *loss of voluntary motion* is most sudden and complete in the cerebral states of the disease, and in cases of injury of the cervical portion of the chord, or of concussion of the spine. When the palsy proceeds from disease of the spinal medulla or of its membranes, the loss of motion is rarely complete at first, and often does not become complete until after several years, and until the organic lesions have advanced so far as evidently to interrupt the functions of the chord. Still, there are exceptions to this, as the case noticed by Sir B. Brodie. During the protracted progress of the malady the patient often experiences spasmodic actions, or more permanent contractions of the muscles, particularly of the flexors; frequently a sense of painful constriction around the abdomen and the thighs; and sometimes, especially when the upper part of the cervical medulla is implicated, even convulsions or complete epileptic attacks. These are evidently the consequence of inflammatory action or irritation in or near the portion of the chord or its membranes which is the seat of lesion.

80. A compositor, who was engaged in printing a work which I was editing many years ago, came to me with caries of one or two of the upper dorsal vertebræ. Matter had evidently formed, and was making its way externally. He became paraplegic, and subsequently generally paralytic; but at a very early period of the paraplegic state fully-developed epileptic seizures occurred. These became more frequent, and ultimately terminated in coma and death. On examination, a sanious pus was found collected around the second and third dorsal vertebræ, extending between the muscles, and between the theca vertebralis and bodies of the vertebræ. The membranes at, and to a considerable extent above, this part were inflamed, the arachnoid surfaces being partially covered with lymph or adherent. Injection of the vessels and effused serum were traced thence along the membranes to the brain. The chord itself was not, however, materially changed.

81. *γ. Pain*, even of a most severe character, is often remarked, particularly in the inflammatory states of the spinal disease, and when the roots of the nerves, or when the nerves, as they pass through the spinal foramina, are implicated in the lesion. The pains are usually deep-seated in one or more limbs, and are often not the less acute where the cutaneous sensibility is much impaired. In some instances of spinal general palsy the sensibility of the surface, particularly at first, is painfully increased, and sometimes even perverted. Pain is often felt in the part of the spine affected, either primarily or consecutively. In some instances, particularly when the disease commences in the lower portion of the spine and extends upward, it may be confounded with lumbago; or it may be viewed as originating in lumbago, the pain in the loins being caused either by inflammatory action or softening, or by congestion of the spinal veins and sinuses. When the disease is consequent upon masturbation or venereal excesses, it is often preceded and attended by pain in the loins, extending upward with the local lesion and the paralytic symptoms.

82. *δ.* The *bowels* are remarkably torpid, and

the evacuations in the more complete states of the disease, dark, and like tar or treacle (§ 59). The *urinary organs* are affected in the more complete and advanced forms, in the manner already noticed (§ 57, 58); but, in the less complete states, and when the spinal chord itself is not materially changed, the patient still retains more or less power over the evacuations and actions of the sphincters. In the more severe and sudden cases, particularly those consequent upon injury of any kind, and attended by marked disturbance of the urinary functions, priapism is a frequent symptom.

83. *ε.* The *external surface* is always dry, often scurfy, sometimes discoloured in the extremities, or presenting livid spots resembling vibices. It is generally emaciated, and colder than natural, even when the patient complains of a sensation of heat. The disposition of the surface to ulcerate or slough on pressure, so remarkable in paraplegia, is less so in general palsy, unless at the last stage or more severe and complete state of this latter form of the disease.

84. *ζ.* The *cerebral functions*—sensation and intellectual power—are unaffected in general palsy as well as in paraplegia, and continue unimpaired until the malady terminates either in fatal congestion of the lungs, or asphyxia, or in congestion of the brain with serous effusion.

85. II. OF PARALYSIS IN NEW-BORN INFANTS AND YOUNG CHILDREN.—Paralysis is sometimes met with in new-born infants. It may be the effect of injury to the nerve either in the part paralyzed or in its course after its transmission through the cranial or spinal aperture. Dr. E. KENNEDY remarks that we have examples of this fact in injury to the portio dura, as in face presentations; or where the head has been long pressed in the pelvis against the projecting ischiatic spines; and he adds, that several cases of this kind had occurred to him in which the disease was quite local, the paralysis being removed on the subsidence of the swelling produced by the protracted pressure.—*a.* I have already mentioned (§ 44) that the paralysis may be the result, not merely of spontaneous lesion of some part of the nervous centres during fœtal life, but also of arrested development or insufficient growth during the early periods of this epoch. In this latter case the palsy is often associated with idiocy. The cerebral or spinal lesion may, however, occur shortly before, as well as during the period of parturition. In the following case, recorded by Dr. E. KENNEDY, the lesion must have existed some time before birth; and probably, from the speedy recovery, consisted merely of congestion of one side of the brain.

86. Immediately after birth a large, soft tumour was observed on the right side of the head, principally on the vertex, with two or three small excoriations on the left side. The left eye was closed; the mouth drawn to the left side; and when the child cried, the *ala nasi* and angle of the mouth were drawn up; the right eye was open, and the right side of the face unaffected during crying. The left side of the body was completely paralyzed. The extremities of this side were of less bulk than those of the right, and were rough to the touch; the muscles were flabby. Both pupils were insensible to light. The child was unable to suck; but deglutition did not seem to be affected. On the third day it had several slight convulsions, confined to the upper half of the body. A leech was applied to the vertex, followed by the warm bath: stimulating liniments were rubbed over the spine, and the child recovered. In this interesting case the portia dura of the right side, and the levator palpebræ of the left side, supplied by the third nerve, were paralyzed, in connexion with hemiplegia of the left side.

87. It is often difficult to ascertain the extent of paralysis in new-born infants and very young children, as the paralyzed limbs are generally either so much convulsed, or so spasmodically contracted, as to be removed from under the influence of volition. When the spasms cease, the paralyzed state of the limb sometimes becomes more evident in the more unfavourable cases. The lesions which most frequently occasion paralysis in this class of subjects are, congestions of the brain and spinal column, serous effusion either between the membranes or in the ventricles, and extravasation of blood. This last is much less frequent in children and infants than in adults, and very rarely occurs in the cerebral structure. When hæmorrhage takes place within the cranium or spinal canal of infants, it is generally found to proceed from the surface of the membranes, and seldom causes permanent paralysis, but usually apoplectic attacks, or eclampsia, trismus, or convulsions, terminating generally in death. In these cases the effused blood produces either coma, spasm, or convulsions, according to the quantity effused; and ultimately, if the child live a short time, inflammatory action in the parts into which it is extravasated, owing to the irritation it occasions.

88. *b.* Paralysis, sometimes partial, at other times more or less general, accompanies the advanced progress of the disease usually called acute hydrocephalus, and of true or chronic dropsy of the brain. In the former of these maladies (*see* DROPSY, *acute, of the Brain*), I have shown that the palsy is the consequence of the softening of the more central parts of the brain, rather than of the effusion into the ventricles which either attends or supervenes on the softening. The tubercles sometimes found in the brain, or its membranes, of children, either associated with, or independent of, softening and serous effusion, are rarely a cause of paralysis, unless at an advanced stage of these lesions, or as a termination of convulsions or spasms, with which, however, some degree of paralysis is occasionally associated.

89. *c.* But palsy is sometimes met with under different circumstances, especially during suckling and teething; and, although not so frequently as immediately after birth, still sufficiently often to have procured for it, as occurring at this period, more attention than has been paid to it. From the first dentition to the period of puberty, paralysis is generally the consequence of scrofulous caries or disease of the vertebræ, or of softening of a portion of the brain, or of tubercles within the cranium or spine. In cases of softening or tubercles in the brain or its membranes, convulsions, more or less of an epileptic character, almost always precede the paralysis, which commences generally in one arm, and sometimes passes into

hemiplegia. When these lesions are seated within the spinal canal of young children, convulsions of a more limited character, often spasms or contraction of a limb, are more frequently remarked either before the development of palsy, or in connexion with it; although, even in these cases, the convulsions may assume an epileptic character, particularly when the upper part of the chord is implicated.

90. *d. Infantile paralysis* may, therefore, be divided as follows: 1st. The congenital, and then it is commonly a consequence of arrested development or congestion of a portion of the cerebro-spinal centres; 2d. That caused by the accidents attending parturition, as shown above (§ 85); 3d. That consequent upon lesions or spontaneous disease, of a demonstrable nature, implicating the brain or some portion of the cerebro-spinal axis; and, 4th. That which presents no obvious lesion in the brain and spinal chord beyond slight congestion, and from which recovery often takes place without sufficient evidence of organic lesion having been afforded. This last class of infantile palsies generally occurs in infants at the breast or during the first dentition. It is often sudden in its accession, and is preceded by no very apparent state of disease, beyond the usual irritation often attending dentition, or disorder of the alimentary canal or biliary functions. The arm is commonly the part affected; but the leg of the same side is sometimes either also paralyzed, or contracted and drawn up, or both palsied and contracted. Sensibility has not been, as far as I have observed, impaired in the affected limb, but, on the contrary, sometimes morbidly increased. A large proportion of the cases which I have seen of this description has recovered after the means that will be noticed in the sequel have been employed.

91. My very learned friend, Dr. M'Cormac, of Belfast, has noticed cases of paraplegia in infants, which he considered to proceed from concussion of the spinal chord: a cause by no means unlikely to produce the disease in both infants and children, and to be followed by either hæmorrhage, inflammation, softening, serous effusion, or other change of the parts lodged in the spinal canal. He believes, also, that injury to the sciatic nerve may produce paralysis of the limb in infants; but this is manifestly a rare occurrence.

III. Shaking Palsy.—Syn. *Scelotyrbe festinans*, Sauvages. *Paralysis Agitans*, Parkinson. *Synclonus ballismus*, Good. *Tremor*, J. Frank. *Tromos* (Τρόμος), Swediaur. *Tremblement*, Fr. *Zittern*, Germ. *Trembling Palsy.*

92. This disease is *characterized by a tremulous agitation, a continued shaking, and by great weakness of one or more parts or members of the body.* Although it was described by Harscher, Diemerbroeck, Schelhammer, Hamberger, and others, and more recently by Parkinson and J. Frank, it has not received the attention which the frequency of its occurrence and the obscurity of its nature should have obtained for it. Even its symptoms, its relations to other nervous affections, its course and terminations, have been imperfectly observed and described; and no accounts have been furnished of the appearances observed in fatal cases.

93. Shaking palsy may affect either a single part or limb, or many parts, or even the greater part of the body. It may continue *limited* to its original seat for many years, and even never extend beyond it; or it may not only increase gradually in the part first affected, but *extend* to two, or to all the limbs of the body. Generally the power of motion only is affected, and usually is only partially impaired; and it continues long in this state; so that the complaint may be viewed as *imperfect palsy of the power of motion, with shaking of the part.*

94. The affection usually commences imperceptibly, and proceeds slowly. It often begins in the head, or in one or both arms, and it frequently is confined to these parts for a long period, or even for years. It is generally attended by a feeling of weakness of the part. In two instances I have seen the complaint limited to the lower jaw, which was moved by a rotatory or lateral action in one case, and by a vertical action in the other. When the head is affected, it is commonly moved upward and downward; but it is in some instances in a constant state of rotation. In these situations, as well as when it affects the hands and arms, the motion often does not exceed that of tremour, or a gentle but quick shaking; but in others the agitation is more remarkable and violent; and even the slighter cases may be more severe when the patient is influenced by any excitement or marked emotion of mind.

95. The affection commences usually with a slight sense of weakness and proneness to trembling, especially on any emotion or after physical exertion, and commonly in the hands or arms, but sometimes in the head, or in the tongue or lower jaw. These symptoms gradually and slowly increase; and usually after one, two, or three years, but in some cases not until after a longer period, they extend to the lower extremities; and the patient finds great difficulty in walking; bends his body forward, and is obliged to assume a hasty or rapid pace, from the fear of falling forward. The tremulous agitation has now extended to his legs, and the limbs have become less and less capable of obeying volition. Suspension of the agitation is seldom experienced, unless in some cases when the limbs are held or supported; and when it ceases from this circumstance in one limb or side, it continues in the other. Thus it sometimes ceases in the arm or side on which the patient lies or reclines, but as soon as he changes to the opposite side it begins in the former. Occasionally, attempts to restrain the agitation only increase it; and it is often exasperated at the sight of strangers. When the patient walks, he is often thrown on the fore part of the feet, and impelled to adopt a quick or running pace, from fear of falling at every step on his face. At an early stage, or in less severe cases, the affection ceases for a short time, or is ameliorated after a refreshing sleep; and it is often then controlled by the will or by earnest attention to the part, but it soon afterward recommences.

96. At a far-advanced stage, the tremulous motions of the limbs occur during sleep, and, particularly when the patient dreams, waken him, often in agitation. The power to convey food to the mouth ultimately becomes so impeded as to oblige him to be fed by others. Mastication and deglutition are impeded, or difficult, and the saliva dribbles from the mouth

The trunk is permanently bowed, from the general want of power in the muscles. The bowels are costive; are acted upon with difficulty; and sometimes require mechanical means to remove them from the rectum. Ultimately, the agitation becomes more vehement and constant; and when exhaustion passes into sleep, it sometimes becomes so violent as to shake the room. The head falls down, so that the relaxed or shaking jaw meets the sternum. The power of articulation fails or is lost, and the urine and fæces are passed involuntarily. Slight, low delirium, passing into coma, usually terminates life.

97. I have met with this affection both as the chief and primary malady, and in connexion with disease in some distant organ, of which it appeared either as a consecutive change, or as a concomitant disorder. I have seen it more frequently in males than females, and chiefly in persons about fifty years of age and upward. I observed it to a very remarkable extent in a man aged about sixty, who had valvular disease of the heart, upon which pulmonary congestion and dropsy supervened; but I could not obtain permission to examine the body. I observed it also in a lady in a similar form of complication, but I ceased to attend her long before her death. I was recently consulted by a gentleman from Lancashire, affected by this complaint in the arms, and in every other respect he professed himself to have been in good health. I have seen it both in plethoric and in thin and spare habits, but more frequently in the fair and sanguine than in any other temperament. I have never had an opportunity of observing the changes that existed after a fatal termination of the complaint, and I do not recollect of any case being recorded where such an opportunity had been enjoyed. It is frequent in very aged persons in its slighter forms.

98. In rare instances *hysteria* assumes a form very nearly allied to, or closely resembling, this affection. In 1842 I attended, with Dr. N. GRANT, a girl aged about sixteen, on account of various anomalous nervous affections consequent upon obstructed catamenia. After passing through various phases, in which the tongue, larynx, and diaphragm seemed spasmodically affected, violent tremulous agitation of the head and arms supervened. The head was rotated from side to side without intermission for several days. She received benefit from treatment, and ultimately recovered.

99. In the absence of *post-mortem* examinations, opinions as to the origin and seat of this complaint must be viewed as suppositions merely; but it is not unreasonable to infer that the medulla oblongata and upper part of the spinal chord are the chief seat of the affection. J. FRANK adduces the case of a widow, aged forty, who had experienced an interruption of the catamenia, had complained of pain in the spine, and had recourse to a vapour bath; after coming out of the bath she was exposed to cold, and suddenly was attacked by this affection Her head was in a constant state of rotation, and the arms, hands, legs, and feet were in continual motion. Blood was taken from the spine by cupping, and she recovered sooner than was expected. It is not improbably connected with congestion of the venous plexuses, or sinuses, placed between the sheath of the chord and bodies of the vertebræ, particularly in persons of a plethoric habit, and when it is consequent upon suppressed evacuations. In other cases it appears to depend more upon the states of the chord and nerves, or to be more strictly nervous.

100. IV. PARALYSIS FROM POISONS.—*Paralysis venenata*, CULLEN.—*Paralysis e venenis.*—Palsy, varying as to seat and character, is not infrequently observed consequent upon the operation of several poisonous substances of either a mineral or vegetable nature, especially the former. The poisons most liable to cause palsy are lead, mercury, arsenic, ergot of rye, monkshood, thorn-apple; and in rare instances palsy occurs as a contingent remote effect of most of the acro-narcotic poisons.

101. *A. Palsy from Lead.—Lead palsy* generally occurs after one or more attacks of colic (see COLIC FROM LEAD); but it occasionally appears without any severe disorder of the digestive organs. When the palsy is connected with colic it usually becomes manifest as the colic subsides; but both affections may be associated or cotemporaneous. When the palsy occurs independently of colic, costiveness and indigestion, with or without slight pains in the abdomen, are generally present, both before and concomitantly with it. The palsy usually presents peculiar characters. It is seated chiefly in the upper extremities, and affects the extensor more than the flexor muscles. It is attended by great emaciation of the affected muscles, and the loss of power is most remarkable in the muscles which move the thumb and fingers. The palsy is seldom complete, even in these, except in the extensors. The hands and fingers are constantly bent, unless when they hang down by the sides. The patient, in the most severe cases, is unable to raise them, and, when one arm is more affected than another, he raises the one by the aid of the other. Severe pains are also felt in the lower limbs and arms. Attacks of colic, severe fits of indigestion, and obstinate constipation are apt to occur, especially after irregularities of diet or exposure, and generally carry off the patient. The palsy of the arms is sometimes associated with deafness, owing to palsy of the auditory nerves.

102. In fatal cases the paralyzed muscles have been found pale, bloodless, and flaccid; and in cases of long standing they have become still more pale and fibrous. The nerves have also appeared atrophied and firmer than natural. It is not improbable that the lead, in a state of oxide, has in some measure combined with these tissues. In this case, however, it ought to be detected by chemical analysis; but, while some chemists avow that they have detected it, others assert that they were unable to do so. Dr. CHRISTISON'S able researches into this subject do not countenance the opinion that a combination takes place between the lead and tissues affected in these cases. That the metal affects the states of these tissues cannot be doubted; but whether by its actual presence, or by its indirect operation on the nerves and nutrition of the muscles, independently of its presence, has not been demonstrated. Most probably its operation is direct in the state either of an oxide or of a salt, in either of which states it may pass into the cir-

culation, and act immediately upon the nerves and muscles.

103. *B. Mercury*, when carried into the system in the form of an oxide, or of a salt, sometimes causes palsy, but generally in the form described as shaking palsy (§ 92), or *incomplete palsy of motion with tremour*—the *tremblement métallique* of French writers. It usually occurs in miners, in gilders, and in other workmen exposed to the operation of mercurial substances. It usually commences with unsteadiness of the arms, and afterward with tremours, which extend more or less with the continuance of the malady, and often becomes associated with convulsions. For a fuller account of this affection I may refer to the article Arts and Emplovments (§ 24).

104. *C. Arsenic* sometimes occasions limited or partial palsy, when it has failed of causing fatal effects in a short time, or in the advanced stage of the more prolonged cases of poisoning by it. In some cases an incomplete form of paralysis, resembling palsy from lead, and affecting one or more of the extremities, is caused by this poison. Occasionally the palsy is preceded by cramps, tenderness, and weakness of the extremities, the palsy being sometimes attended by contractions of the joints. The affection is not confined to the power of motion, but generally also extends to that of sensation. Dr. Falconer observed a case in which the palsy was limited to the hands, and another in which it gradually extended to the shoulders.

105. *D. Paralysis from narcotic or acro-narcotic poisons* is sometimes observed contingently upon their more remote effects. I was consulted many years ago respecting a case of hemiplegia caused by eating the root of monkshood by mistake. The more immediate effects had been numbness and palsy of the tongue, followed by apoplexy, and a state of the cutaneous and mucous surfaces closely resembling that existing in fully-developed purpura hæmorrhagica. The apoplexy had been either associated with hemiplegia from the commencement, or the latter rapidly followed it. The patient, aged about twenty, ultimately recovered, and I lately saw him without any remains of the paralytic affection, which, however, had continued during two or three years. Paralysis from this class of poisons generally affects the powers of sensation more or less remarkably.

106. *E. Ergot*, or *spurred rye*, sometimes occasions palsy, especially of sensation; but the effects of this substance are fully treated of in the article Ergotism.

107. V. General History of Palsy.—i. Of the various Disorders preceding and attending Palsy.—From the description of the several varieties of palsy, it will be seen that the power of motion is much more frequently impaired than that of sensation; that either may be singly, or both jointly affected in various grades, but that, when motion is totally lost, sensation is frequently more or less impaired; that sensibility is very rarely entirely lost in a paralyzed part, and still more rarely over the surface of the body; and that palsy is both preceded and accompanied by considerable derangement of the general health as well as of the nervous system, to which especial attention should be directed.

108. *A.* It is impossible to notice all *the premonitory symptoms of palsy*, as the varieties and relations of the malady are so numerous as to render them both diversified and inconstant, and as they depend very much upon the nature of the pre-existing disorder and of the remote causes. *Hemiplegic palsy* is often preceded by the same premonitory symptoms as have been mentioned in connexion with the accession of Apoplexy (§ 4), especially by various affections or disorders of one or more of the senses, particularly of hearing, sight, and touch; by neuralgic pains about the face or head; by twitchings, spasms, or convulsions; by weakness of muscles, or of a limb; by headaches, restlessness, sopor, lethargy, or watchfulness; vertigo, faintness, and unsteady gait; irritability of temper, loss of memory; imperfect or difficult utterance; flatulence, costiveness, and various dyspeptic symptoms; more or less manifest indications of irritation or inflammatory action in some part of the brain; epileptic seizures, and most frequently apoplectic attacks. (*See above*, § 40, and art. Apoplexy, § 4.)

109. The *paraplegic and general states of palsy* are often preceded by pain in the course of the spine, sometimes resembling, and frequently mistaken for, lumbago; by spasms or cramps of particular muscles; by pain in the neck, or wry-neck; by neuralgia or neuralgic pains; by numbness of the toes or fingers; by attacks of nephritis; by increased sensibility of the surface of one or more limbs, or of the body generally; by costiveness and colicky pains, or obstinate constipation; by retention of, or difficulty of voiding, the urine; by chorea, partial convulsions, or various anomalous nervous disorders; and by the more limited forms of partial palsy.

110. *B. The disorders of the nervous system, and of the general health, accompanying palsy*, are various in different cases, according to the seat of the malady.—*a.* In *hemiplegia* and palsy of any of the organs of sense, the memory, and, in severe or prolonged cases, even the intellectual powers, are more or less impaired, the palsy extending even to the mental powers. This state, however, is the most remarkable in the complication of general palsy with insanity, hereafter to be noticed. The temper and disposition are often changed from their usual characteristics, persons of a mild disposition becoming peevish and irritable, and those who have been irascible becoming placid; in some cases the memory, chiefly of words or of names, is impaired or perverted, so that the patient substitutes those which either are inappropriate, or have an opposite meaning to that which he wished to convey. The powers of attention, and application, and mental energy generally, are usually impaired.

111. The action of the *heart* and *lungs* is seldom much excited in hemiplegia or cerebral palsy, unless when inflammation of a portion of the brain supervenes upon or attends the lesion causing the hemiplegic state. Nor is the action of these organs oppressed or impaired, unless effusion, so as to cause direct or counter pressure, takes place, or the medulla oblongata becomes in any way implicated. Hence the temperature of the surface of paralyzed parts is seldom lower than natural, and frequently, owing to diminished transpiration

from the surface of these parts, it is higher than in other situations.

112. *Digestion* and *assimilation* are often but little disturbed or impaired. In some cases vomiting or nausea, with or without flatulence, attends the accession of hemiplegia, but subsequently acidity, heartburn, or flatulence, is complained of. The appetite is but little impaired; it is even frequently keen or craving, and is generally too great for the amount of exercise taken, and of air consumed by respiration, and consequently for complete digestion and assimilation. This keenness or craving appetite I have often remarked as an indication of latent irritation in the substance of the brain. The bowels and liver are usually torpid, and often require powerful chologogues and purgatives to act on them.

113. The *nutrition* of a paralyzed part is often not materially affected when the disease occurs after the growth of the body has been matured. Occasionally, however, some degree of shrinking, or atrophy, exists, especially in prolonged cases, owing chiefly to disuse of the muscles. The nerves are also somewhat atrophied. Very frequently an œdematous state of a paralyzed limb is observed, increasing its bulk, although the muscular and other soft parts may be more or less wasted or atrophied. The urinary functions are seldom much affected in hemiplegia and other cerebral forms of palsy.

114. *b.* In *paraplegia and general palsy* the attendant phenomena have been already fully noticed (§ 48, *et seq.*), and consist chiefly of lesion of those functions which depend upon, or are influenced by, the part of the chord which is the seat of disease. As the brain continues unaffected until the fatal termination of the disease draws near, so the mental powers continue unimpaired till that period arrives.

115. When the medulla oblongata, or upper part of the chord, is affected, the *action of the heart* and *lungs* is often much disordered; and if these parts, especially the former, are pressed on, or much disorganized, death by asphyxia is more or less speedily produced. In slighter lesions of these parts, remarkable slowness of the pulse in some cases, and great rapidity of it in others, are often observed.

116. Respiration is usually performed chiefly by the diaphragm, and the quantity of oxygen consumed during the process is very small, consequently the heat of the surface is low, and transpiration from it much diminished. The skin is dry, becomes covered with a branny or furfuraceous substance, owing to rapid exfoliation of the cuticle. When the lesion is seated lower in the chord, or so as not to impede the motion of the chest, and, consequently, not to diminish the action of the air on the blood, the parts below the seat of injury experience diminished or interrupted cutaneous transpiration, and, instead of any diminution of temperature, they present an actual rise of temperature, owing to the interrupted transpiration, the functions of respiration not being impaired.

117. The *heat of the surface* of paralyzed parts depends upon the state of respiration and the consumption of oxygen, in connexion with the amount of transpiration from that surface; for, while the oxygenation of the blood proceeds without diminution, suppression of the cutaneous transpiration will raise the temperature of the surface on which transpiration is suppressed; but when the oxygenation of the blood is impaired, suppressed transpiration cannot have this effect, or only to a small amount. If the change produced by respiration on the blood be much impeded, the temperature will generally continue much below the natural standard. This appears to me to be the true cause of the different states of temperature of paralyzed limbs in different cases; and it is preferable to account for the phenomenon conformably with established principles, upon which a sound and safe practice may be based, than to mould it so as to suit a preconceived hypothesis, and to make it subserve a doubtful or hazardous treatment.

118. It may be objected, however, that the rise or fall of temperature in a paralyzed or in an inflamed part may be independent, in some degree, of states of respiration; and this is actually the case; for, although the passage of oxygen into the circulation takes place in the lungs, the oxygenation of the blood, or, rather, of certain elements of the blood, occurs chiefly in the systemic capillaries, under the influence of the organic nervous power, the oxygen combining partly with these elements for the nutrition of the tissues, and partly with the carbon of the blood. The change in the capacity for latent heat consequent upon the combination of oxygen with these elements in the several parts of the body is great in proportion to the extent of combination; and, as this combination is strictly a vital process, or at least brought about by vitality, although conformably with chemical laws, so it takes place independently of the cerebro-spinal nervous system Notwithstanding that this combination and the change of capacity for caloric consequent upon it are independent of this system, and are effected chiefly by vital or ganglial nervous power, still they may be influenced by the cerebro-spinal system. The passions and emotions show this; but they also prove the predominant influence of the organic nervous system, their physical action—their operation on the circulation and the tissues—being through the medium of this latter system. Fear blanches the cheek and lowers the temperature of the surface; sexual passion produces turgescence of the erectile tissues and heightens the temperature; but these, as well as other mental emotions, change the state of the circulation and temperature by depressing or exciting, according to the nature of the emotion, the organic nervous or vital power in the first instance, the effect upon the circulation and temperature being consecutive. The independence of the organic or vital nervous system of the cerebro-spinal is shown, even in those vital organs which are most influenced by the mental emotions and the spinal chord, in the course of paralytic cases. Thus palsy, even when general, does not extend to the organs of generation. Erections take place in almost all the varieties of the disease, if no other concomitant complaint exist to prevent them; they are even morbidly frequent or constant when the upper part of the spinal chord is congested, inflamed, or otherwise implicated. Pregnancy proceeds in its usual course, and parturition

takes place in the natural way, in cases of paraplegia or general palsy in females.

119. When the upper part of the chord is the seat of lesion, the *stomach* is sometimes so much disordered as to reject its contents. The bowels are obstinately confined, as above noticed (§ 59); the tongue is furred and loaded; the urinary organs remarkably affected (§ 57), and the vital cohesion of the superficial and other tissues below the diseased portion of the chord is more or less impaired, disposing them readily to undergo asthenic inflammation, sloughing, &c. (§ 64.)

120. ii. The Associations and Complications of Palsy.—As palsy is generally a symptom or consequence of some lesion sustained in a part of the cerebro-spinal nervous system and nerves, it will readily be admitted that it will frequently present itself in practice as an accident or result of an immediately antecedent and intimately related disease, and often be associated with such disease—with apoplexy; with inflammation and softening of the brain; with similar lesions of the spinal chord; with structural changes of the membranes of the brain, and of the spinal medulla; with disease of the cranial and spinal bones; with epilepsy, convulsions, hysteria, and catalepsy; with insanity, imbecility, and idiocy; with rheumatism, lumbago, and congestions of the spinal sinuses; with neuralgic affections; with inflammation of the kidneys, or other parts of the urinary apparatus. In the progress of all these maladies, some form or other of palsy may appear whenever lesions of structure, or even congestions, take place in, or extend to, any portion of the cerebro-spinal axis, or nerves proceeding from it during their course; or, in other words, when palsy is complicated with any of these maladies, it is a consequence of the vascular and organic lesions characterizing or supervening in the progress of such malady. The importance and danger of these complications require that a brief notice should be taken of them.

121. *A.* Of all diseases, *apoplexy* is the most frequently associated with, and the most intimately related to, palsy, especially to hemiplegia, and to some states of general and partial palsy. The complication of apoplexy with palsy is fully described in the article Apoplexy (§ 31–49). I have there shown that it generally presents itself as follows: 1st. *The apoplexy occurs as the primary malady, and is either associated with, or followed by, paralysis.* 2d. *The paralysis, in some one or other of its partial states, often in that of hemiplegia, first appears, and is followed, after a very indefinite period, by an apoplectic attack more or less profound.*

122. *a.* In the *first* of these complications the paralytic affection may disappear in a short time after the apoplectic seizure, or not until after several days or weeks. It may be permanent, or continue for years, or until another apoplectic seizure carries off the patient; or it may be rendered more complete or general, or it may affect additional or different parts, those first affected being either partially restored or unchanged, by renewed seizures of apoplexy, or by coma, attended by sinking or exhaustion. In these cases death is usually produced by the apoplectic state, or by a comatose sinking, attended by a general palsy, in which, owing, probably, either to nervous exhaustion, or to counter pressure on the base of the brain, or on the medulla oblongata, or to lesions extending to these parts, the respiratory organs participate. I have described fully, in the article just referred to (§ 34, *et seq.*), the lesions usually observed in these circumstances; and I need not, therefore, allude to them farther than to state that, in the slighter and less prolonged instances, they consist chiefly of congestion and serous effusion; and, in the more severe and permanent cases, of extravasations of blood, softening of portions of the brain, and of extravasation and softening conjoined. In some cases little or no lesion is seen, or at least lesions insufficient to account for the phenomena and for death; and in other cases, in connexion with one or more of these lesions, effusion of serum in the ventricles, or between the membranes; inflammation of a portion of the brain, or of the membranes, and other concomitant or contingent lesions, are observed. (See art. Apoplexy, § 36, *et seq.*)

123. *b.* In the *second* of these forms of complication (§ 121) the palsy in some one or other of its more partial forms, frequently in that of hemiplegia, is the primary seizure, and is generally then caused by alterations in some part of the substance of the brain, especially by softening, hæmorrhage, cysts, tumours, tubercles, and by almost any of the diversified lesions described in the article Brain and its Membranes, particularly when they have arrived at an advanced state of development. Many of these lesions are followed by inflammation, softening, congestion, or effusion of serum or of blood in the brain or its membranes, causing either a more complete or a more extensive palsy, or spasms or contractions of one or more limbs, or superinducing apoplexy, which may either terminate life, or be removed, leaving the pre-existing palsy more complete or extended than before. (See arts. Apoplexy, § 46, *et seq.*, and Brain.)

124. *B.* Palsy may become associated with *epilepsy*; but it is generally a consequence, even when thus associated, of repeated returns of the epileptic paroxysms. Even in the earlier attacks of epilepsy, occurring in young persons, the epileptic fit may be followed by incomplete palsy of the limb, or of certain muscles, especially of an arm, or of the muscles of articulation, &c. In these cases the palsy may soon disappear, and follow the next or subsequent attacks; and may continue without much variation, or become more complete until either hemiplegia, or even more general palsy, supervenes. In some instances the epileptic seizure may present a mixed character, or a state intermediate between apoplexy and epilepsy; or it may be viewed as apoplexy attended by convulsions, a form of seizure which had been overlooked until it was described in the early parts of this work. These mixed forms of seizure are not infrequently followed by palsy. It has been stated in the articles Brain and Epilepsy, that any organic lesion of the brain or of its membranes may be followed by epileptic attacks; and these lesions, in a more advanced stage of development, may occasion either palsy or apoplexy; often both in succession, at very indefinite intervals. The slighter states of palsy consequent upon the ep-

ileptic fit may be viewed as the result of congestion, more particularly affecting that portion of the brain that has most intimate relations to the paralyzed part. Where, however, the palsy is more complete or extensive and permanent, it may be viewed as depending upon similar changes to those which have been alluded to as causing palsy in connexion with apoplexy (§ 121); and if the palsy he attended by contractions or spasms either of the paralyzed or of the sound limbs, inflammatory action or irritation may he inferred to exist either in the vicinity of the cerebral lesion, or in another part of the brain, according to the seat and character of the spasms, &c. In rare instances, the same lesion of the brain that causes the epileptic or convulsive seizure may induce at the same time a paralytic state. These cases usually soon terminate fatally.

125. *C. Inflammation of the brain* may he complicated with palsy; but in this state of disease the inflammation is generally limited to a portion of the brain. Either affection may be primary, and thereby give rise to two states in which this complication presents itself in practice. 1. *The changes consequent upon the inflammation may induce those farther changes upon which the palsy depends*; thus, inflammatory softening favours cerebral hæmorrhage, and this latter usually causes the paralytic state. 2. *The lesion primarily causing the palsy may induce inflammation of the adjoining parts of the brain, and the phenomena usually consequent upon this state*; thus, blood extravasated, or a tumour formed in the brain, will occasion palsy, and inflammatory action will often follow in the surrounding cerebral structure, or in the adjoining membranes, or in both structures, and give rise to the association of the chief phenomena of inflammation of the brain, or of its membranes, with the paralytic state. Both these states of association may present themselves even in the same case; thus, a gentleman, attended by Dr. Paris and the author, had inflammation of the brain, and after the more acute attack had been removed, hemiplegia supervened. The hæmorrhage, consequent upon the inflammatory softening, and productive of the palsy, after a short time reproduced the inflammation, which was again subdued; but after some months an apoplectic seizure took place, and carried off the patient. In cases of this complication, the membranes may or may not be implicated, according to the seat of primary lesion, or to the nature of that lesion.

126. *D. The complication of insanity with palsy* has been very fully discussed in the article on Insanity (see § 33–36, and 167–172); and I, therefore, need not farther allude to the subject at this place than to state that the palsy generally does not appear until after the mental disorder; often not until the latter has continued for a considerable time, and assumed a chronic and general form. In some cases, however, insanity and palsy occur almost simultaneously; and in a few the paralytic affection precedes the mental derangement. Palsy thus associated is commonly *general*, or soon becomes such. It is usually incomplete, especially in its early stages, and affects chiefly the muscular system. The sphincters, and, consequently, the evacuations, are uncontrolled by volition. This form or association of palsy is usually a result of chronic inflammation of the brain, and is distinct from palsy caused by cerebral hæmorrhage, softening, tumours, &c., which, however, may also occasion the more partial, or a hemiplegic form of palsy in the course of insanity; but these latter are not so frequent as the general palsy just alluded to, and fully described in its more appropriate place (Insanity, § 167, *et seq.*). The paralysis of the insane may he farther *associated* with epileptic, convulsive, apoplectic, or comatose states, either of which may terminate life, or the patient may sink from vital exhaustion. The appearances observed after death from these complications are minutely described in the art. Insanity (§ 235, *et seq.*).

127 Palsy is not infrequently, also, associated with *idiocy*, and with *puerile imbecility* (see art. Insanity, § 522, *et seq.*). In these complications the palsy may be either general or partial; but when it is general, some parts are usually more affected than others, and imperfect development of portions of the cerebro-spinal axis is often seen on examinations of them after death.

128. *E.* Although both *paraplegia and general palsy* are often produced by the more common consequences of *inflammation of the spinal chord* and *of its membranes*, still the inflammation, as well as those consequences, may still continue after the paralytic state has been produced, and thus become *associated* or *complicated with it*. The history of cases of this description, and some of those above noticed, suggests this position; and the appearances I have observed during the examination after death sufficiently confirm it. The importance of attending to this circumstance cannot he over-estimated in a practical point of view, as being suggestive of a rational treatment of these cases. The persistence of inflammatory action in the spinal chord and its membranes, particularly the latter, during the paralytic states depending upon lesions of these parts, is often evinced by pain in the spine, by spasms or contractions of the muscles, by pains in the limbs, and by the various phenomena usually attending inflammations. In some instances, the inflammation occasions not merely spasm, contraction, or pain of the muscles supplied with nerves from the part of the spinal chord which it affects, but also more general convulsions; or, when the upper parts of the chord are implicated, epileptic seizures, or coma and asphyxia.

129. *F.* Disease of the *cranial and vertebral bones*, or of *the periosteum*, sometimes *complicates* as well as *causes palsy*, particularly in the scrofulous diathesis. In these cases the disease of the bones extends to the membranes enveloping the brain or chord; and inflammation, with its usual consequences, when affecting these membranes, supervenes and interrupts the functions of, or extends to, the enclosed portion of the cerebral or spinal structure. Thus, I have repeatedly met with instances of caries of the petrous portion of the temporal bone, consequent upon neglected otorhœa, that were followed by inflammation and abscess of the adjoining membranes and cerebral structure, and by palsy, with various concomitant and consecutive phenomena. Cases of this description not infrequently occurred to me in dispensary practice, and in children

at the institution for their diseases. Lesions of the *cranial bones* associated with, as well as causing palsy, may be the result of disease or of injury. Thus, a portion of the parietal bone was remarkably and permanently depressed in a boy by accident, and coma, with hemiplegia, was the result. The coma soon passed off, but the hemiplegia continued for a time. Ultimately, the palsy also was altogether removed; and, long before he reached the period of puberty, the paralyzed side had become as strong as the other. The depression, however, continued as remarkable as before; yet, notwithstanding this, the subject of this accident became, and still is, a most powerful and talented man, with whom I have been acquainted for more than thirty years.

130. Disease, particularly *scrofulous caries of the vertebræ*, is a frequent cause and concomitant of paraplegia, and even of general palsy, as in the case above noticed (§ 68); and not only may the palsy be associated with disease of the vertebræ, but also be farther accompanied with epileptic seizures. A young man several years ago consulted me respecting epileptic attacks, each of which was preceded by the *aura epileptica*, which proceeded from the palm of the left hand to the lower cervical vertebræ. On examining the hand, the palm of it was found swollen, and obscure fluctuation was detected in it. The part was opened, and matter was discharged from beneath the palmar fascia. The fits disappeared for a considerable time; but pain and stiffness in the lower cervical and upper dorsal vertebræ were complained of, and were attended by a diffused swelling. The epileptic attacks returned, and paraplegia, nearly amounting to general palsy, supervened. An abscess pointed between the scapula and spine, which was opened; and the patient soon afterward was carried off by an epileptic seizure. In this case caries of the vertebræ, purulent infiltration of the adjoining muscles, and inflammation of the membranes of the chord, with effusions of coagulated lymph, adhesions, &c., were found after death; and the inflammation of the spinal arachnoid, with serous effusion above the seat of adhesions, had extended to the arachnoid of the medulla oblongata and the base of the brain.

131. *G. Neuralgic affections* of the face, head, or limbs, not only *precede*, but also occasionally *accompany palsy*. The pain sometimes ceases when the palsy takes place, especially if the muscles supplied or connected with the pained nerves are those paralyzed; but it is sometimes only alleviated. The neuralgic pain is occasionally complicated with the palsy, particularly when they occur on different sides of the body. Neuralgic pains may thus accompany hemiplegia, paraplegia, and any of the more partial states of palsy, the latter affection supervening after the former has been of long duration (see art. Neuralgic Affections, § 72). It is only in rare instances that neuralgia appears in the course of palsy, or that the latter is the primary affection.

132. *H.* Palsy is sometimes *associated with rheumatism*, but not so frequently as might appear on a superficial view of the matter. The pains, whether dull, gravative, gnawing, &c., sometimes complained of both before and during paralytic affections, are often mistaken for rheumatism, or for neuralgia, although they are the not infrequent attendants of that change of structure at the origins of the nerves supplying the pained parts that ultimately produces palsy. The pains may be even felt in different parts from those which are paralyzed; and they are then to be viewed as the extension of inflammation, or of other organic lesions, to parts differently related. The pains in the loins or back, so often viewed as *lumbago*, and felt more or less by persons addicted to venereal excesses or to manustrupation, are occasioned either by congestion of the spinal sinuses, or by inflammatory action of the membranes of the chord; and although they are most frequently the precursors of palsy, particularly of paraplegia, still they not infrequently accompany it, and extend either to the sound or to the affected limb, or even to both.

133. *I.* Palsy, or palsy associated with apoplexy, is not infrequently consequent upon *organic disease of the heart*, particularly hypertrophy of the left ventricle, and lesions of the valves or auriculo-ventricular orifices. The remarks which I offered in the art. Apoplexy (§ 96) on the connexion subsisting between that disease and structural changes in the heart are quite applicable to the complication of those changes with palsy, especially with hemiplegia. In this complication the disease of the heart is generally the primary malady, and more or less aids in the production of the paralytic affection, although some lesion of the vessels or substance of the brain may have pre-existed, or have been cotemporaneous with the cardiac disease.

134. *K. The association of palsy* with *disease of the kidneys* and *urinary organs generally* has already been noticed, with reference only, however, to the supervention of disease of the latter upon paraplegia and general palsy (§ 57). But the complication now to be noticed is of a different kind. When the kidneys, either from intense inflammation or from a primary state of inaction or palsy, cease to perform their functions, and retention of urine from this cause results, a state of excrementitious plethora is produced, not infrequently terminating in fatal coma or apoplexy. These may assume the form of general palsy; and, in rare cases, hemiplegia may take place. In these the procession of morbid phenomena is sufficiently manifest; but in others it is much less so, especially in those which present the occurrence of paraplegia consequent upon the nephritic disease. Mr. Stanley, in an interesting memoir (*Trans. of Med. and Chirurg. Soc.*, vol. xviii., p. 260), has adduced several cases, in which inflammation of the kidneys existed in connexion with paraplegia, and appeared as the primary malady, and yet no change was observed in the spinal chord or its membranes. Some of the cases deserve a brief notice.

135. A man complained of retention of urine conjoined with paraplegia, motion and sensation being lost. Tenderness on pressure was felt at the third lumbar vertebra. After death no lesion could be detected in the vertebræ, spinal chord, or its membranes. The kidneys presented inflammatory changes, with small abscesses dispersed through their substance.

136. A man had retention of urine consequent upon the suppression of gonorrhœa by

injections. He complained of pain in the back, paralysis of the lower limbs, and of the sphincters. He distinctly traced the course of the pain from the bladder upward to the kidneys and across the loins. On dissection, the kidneys were inflamed, with minute purulent depositions throughout their substance. The bladder was inflamed, and its inner surface partly covered by coagulable lymph. The brain and spinal chord presented no disease.

137. A man, aged thirty, stated that he had been suffering for a day or two from pain in the loins, when he was seized with paraplegia extending to the umbilicus. The loss of motion was complete, and the loss of sensation nearly so. The functions of the brain were unaffected. The urine flowed involuntarily, and three pints were drawn off by the catheter. In sixteen hours from the attack of paraplegia the man suddenly died. The kidneys were found gorged with blood and nearly black. The mucous membrane of the urinary passages was congested. The substance and membranes of the spinal chord and brain were sound, vascular turgescence of these parts being but slightly greater than natural.

138. I believe that, if cases of the kind now adduced were carefully observed at an early stage of their course, sufficient evidence would be found of congestion of the veins or sinuses placed between the sheath of the chord and the bodies of the vertebræ. This congestion would of itself be sufficient to cause disorder of the urinary functions and inflammation of the kidneys and urinary passages, which would react upon, and aggravate the spinal lesion. In the examinations of these cases no mention is made of the state of the venous sinuses of the spine.

139. *L.* Palsy is sometimes *associated with hysteria*, and the association has been noticed in the article Hysteria (§ 35). A remarkable case of this complication was lately attended by Mr. Flockton and myself. A young lady had experienced hysterical symptoms, with irregularity of the catamenia, to which had supervened suppression of this discharge, attacks of vomiting, sometimes alternating with diarrhœa, and complete paraplegia, as respected the power of motion The sensibility was only slightly affected. The urine required to be regularly drawn off. There was no tenderness in the course of the spine; and all the cerebral functions, the organs of sense, the intellectual powers, and the moral feelings seemed to be in unimpaired vigour and duly regulated. She had been long ill, and had been under the care of various eminent men both in London and in fashionable watering-places. The treatment, which will be noticed hereafter, restored her in the course of a few weeks, and after three or four months she was quite recovered.

140. It is very difficult to explain the connexion between hysteria, or disordered states of the female organs, and palsy. But it is not improbable that many of the symptoms, and particularly those of a paralytic character, arise not merely from irritation propagated from the uterine system to the roots of the spinal nerves, or to the spinal chord itself, but rather from superinduced congestion of the spinal veins and sinuses, the congestion being attended either by interruption to the circulation in the chord, or by compression, or even by both. This change will account for the frequent connexion also of palsy of the urinary bladder with hysteria, even when paraplegia is not present. Yet even in these cases, pains in the limbs, with weakness and partial loss of power, are often complained of. When the remote causes of hysteria are considered, particularly in connexion with the effects they produce upon the spinal chord and roots of its nerves, the frequent supervention of congestion of the spinal veins and sinuses may be viewed as altogether conformable with the laws of the animal economy.

141. VI. Diagnosis.—Palsy, in a simple and primary form, cannot be mistaken for any other malady. It is only when it appears secondarily, or associated with any one of the diseases just mentioned, that the diagnosis requires attention; and even then the object is chiefly to ascertain which is the primary affection, to trace the nature of the connexion between them, and to form some idea as to the structural changes upon which the paralytic symptoms, which are usually sufficiently manifest, depend. It is to this last that our chief attention should be directed; this is the great object of diagnosis, and one which is not only very difficult to determine on many occasions, but almost impossible on some.

142. *a.* When palsy presents any of its more *partial states*, the question of its origin will suggest itself; and the chief point to determine is, whether the affection depends upon lesion at the origin of the affected nerve in the cerebro-spinal centre, or whether it proceeds from disease in the course of, or in the nerve itself. If there be no symptoms of disorder referable to the brain or spine; if neither pain, disordered function, nor sensation can be observed; and more especially, if disease implicating the nerve can be detected, the source of the palsy becomes manifest. In palsy of the face, disease of the portio dura, and tumours or matter pressing upon the nerve, are readily detected. When the ganglionic portion of the fifth pair is implicated, the affection of the eye, and the symptoms mentioned above (§ 19–22), in connexion with the states of the other senses, and of the functions of the brain generally, will readily indicate the seat of the disease. The various circumstances of the case will also aid the diagnosis. Previous injury, the presence of tumours, or of periostitis, the scrofulous diathesis, or manifest scrofulous disease, the occupation of the patient, and the operation of lead or arsenical poisons, &c., severally aid the diagnosis.

143. *b. Hemiplegia* is generally caused by disease in one side of the brain; but it may be produced by lesion in one side of the spinal chord, although very rarely. When it proceeds, as it usually does, from the former source, it is often preceded by cerebral symptoms, or attended by an apoplectic seizure. The chief difficulty is to determine the nature of the lesion producing it; for the several changes, upon either of which hemiplegia may depend, are not attended by determinate phenomena. When it proceeds from hæmorrhage it is usually, as above noticed (§ 39, 40), both sudden and complete in its accession, is often not preceded by pain, and is frequently asso-

ciated with apoplexy. If it proceed from softening, or from tumours or morbid growths of any kind (*see art.* Brain, § 111, *et seq.*), it is generally preceded by cerebral symptoms, by various nervous disorders, by pain, &c., and attended by spasms, convulsions, contractions, or pains; its accession is usually slower, and it is at first less complete than in other circumstances. Tubercles in the brain or in its membranes are not infrequently causes of palsy in children from one or two years of age to twelve or fourteen, as stated in the art. Brain (§ 19, 115), and more recently by Dr. H. Green.

144. I may here remark, that considerable lesions, or morbid growths, may exist in or near the periphery of the brain, or implicate chiefly the cineritious substance of the convolutions without causing palsy, although coma, convulsions, or epilepsy generally result. I have remarked this circumstance in several cases; but I have never seen any marked lesion of the central parts of the brain without palsy being present.

145. *c. Paraplegia* has been assigned above (§ 53) chiefly to disease of, or implicating, the spinal chord or its membranes. But it was supposed by Dr. Baillie, Dr. Good, and others to arise much more frequently from disease within the cranium. Many years ago I controverted this doctrine (see *Lond. Medical Repository*, vol. xviii., p. 522, 1822). I then took occasion to state "that, although I admit that paraplegia will sometimes result from lesions seated at the base, or in both sides of the central parts of the brain, still I contend that it most commonly arises from diseases of the spinal chord." "The chief reason of the prevalence of the cerebral pathology of paraplegia appears to be the old physiological opinions respecting the nervous system still entertained by many; and the circumstance of the brains of paraplegic subjects being, in conformity with preconceived notions, the only parts of the nervous masses which, until lately, had attention paid to them. It is by no means unlikely—and many pathologists have recorded the fact—that a patient, who has been for some time paraplegic from lesion in the spinal chord or its membranes, shall die apoplectic, or shall expire from lesions subsequently developed in the brain. This latter morbid structure, instead of being consecutive, may be even co-existent; but, at the present day, I should not expect to hear a pathologist conclude, because he found lesions in the brain, that the paraplegia therefore arose from the cerebral disease only. I would be still more surprised were I to hear the same inference drawn without any examination of the spinal canal or medulla oblongata having been made. Now I do contend that such conclusions have been actually drawn from such inconclusive data as the above by those who suppose—for the inferences of those investigators are but suppositions at the best—that paraplegia is generally seated in the brain." Thus I wrote in 1822, in opposition to the then received doctrine; and now the justice of my views, which even then were based upon tolerably extensive observation, are almost universally acknowledged.

146. Admitting, as I have done, that paraplegia may occur, in rare instances, from disease in both sides of the more central parts of the brain, or near its base, it will be asked, How is paraplegia from this cause to be distinguished from spinal paraplegia? In many cases, the evidence of the former is negative only. There are no circumstances nor symptoms indicating disease in the spinal chord, membranes, or containing parts, and then we are constrained to look to the brain for it. But where, in addition to this evidence, there are indications, antecedently or concomitantly, of cerebral affection—if any of the functions of sense or manifestations of mind be impaired, or otherwise affected, or if headache or vertigo be present—the source of disorder may thus be conceded to the brain.

147. Where it is manifest that the paraplegia proceeds from disease implicating the spinal chord or its membranes, the question as to the nature of that disease is often solved with great difficulty. When paraplegia is caused by accidents, injuries, wounds, &c., the nature, and seat, and direction of these often assist the diagnosis. The suddenness or slowness of the accession of the malady, viewed in connexion with the presence or absence of pain and tenderness in the spine, will often suggest correct views. Thus antecedent pain, tenderness on pressure, &c., and the continued presence of these, constrictive pains in the limbs or in the abdomen, spasms or contractions of the muscles, &c., will indicate congestion or inflammation in some one or more of the constituent tissues of the part, particularly if the palsy supervene gradually, and if the remote or exciting causes are such as are likely to occasion these lesions. If pain in the back occur suddenly, and is attended almost immediately by paraplegia, extravasation of blood may be dreaded; or the displacement of a previously-diseased vertebræ, or sudden effusion produced by disease of the spinal bones, may be inferred. (*See* Spinal Chord and Membranes, *Inflammation of.*)

148. Debility of the muscles of the spine causing curvatures of the column is rarely attended by any considerable degree of paraplegia. When this palsy is associated with disease of the spinal bones, the curvature is *angular*, owing to caries and absorption of one or more of the bodies of these bones. In the former case attempts to straighten the spine are not attended by pain or risk, and the patient can lie on the back or abdomen without pain. In the latter, such attempts are dangerous, or even fatal; as in a case of caries of one or two of the cervical vertebræ, for which a surgeon was consulted, and an attempt which was made to straighten the part was soon afterward followed by general paralysis. I was afterward called to the patient, who recovered after a most protracted confinement. When palsy is associated with angular curvature, as in a case now attended by Mr. Chilcote, which I occasionally see, any attempt to lie on the back, or to straighten the spine, is followed by pain; and in another case just seen by me, such attempts produce convulsions. These attempts always interfere with those processes from which alone recovery is to be expected. (*See art.* Spinal Column.)

149. vi. Consequences, Terminations, and Prognosis.—*A.* Several of the *consequences* of palsy have been already alluded to (§ 56, *et*

seq), but as the affection is chiefly a consequence itself of pre-existing disease, it seldom induces farther change unless what becomes speedily fatal; and that change is seated chiefly around, or in the immediate vicinity of the lesion causing the palsy. Owing to such change, the mental powers are often weakened, or altogether lost in hemiplegia, or attacks of apoplexy or coma supervene; a partial palsy may become more extended; and even imperfect paraplegia may gradually increase and be more complete or be general, ultimately terminating in coma or apoplexy, or in asphyxia from injury to, or counter-pressure on, the medulla oblongata. The principal consequences of palsy, especially when the spinal chord is implicated, are manifested in the urinary organs, the digestive canal, and respiratory functions, and in the weakened state of vital cohesion of the tissues of the paralyzed parts; and these have been severally noticed at length (§ 57–64).

150. *B.* The *terminations* of palsy are chiefly *apoplexy*, *coma*, *sinking* of the *vital powers*, *asphyxia*, *convulsions* or *epileptic seizures* terminating fatally, and more or less complete *recovery*. *Apoplexy* frequently supervenes on hemiplegia or partial palsy, and either aggravates it or terminates life. A state of gradually ingravescent *coma* may also terminate these states of palsy, and even general palsy, although this last variety frequently causes *asphyxia*, death occurring sometimes gradually, at other times suddenly; *gradually*, from defective oxygenation of the blood and diminished production of carbonic acid, coma usually intervening; *suddenly*, owing to the arrest of the actions of the respiratory muscles and functions, and of the heart, consequent upon lesion at the origins, and complete paralysis of the respiratory nerves. In both these latter classes of cases the blood after death is fluid and of a dark venous colour.

151. Paraplegia either passes into general palsy and terminates as stated above (§ 150), or becomes fatal, owing to consecutive changes produced in the urinary organs, or to sloughing of the parts upon which the body rests, sinking of the powers of life, and contamination of the circulating fluids arising from these alterations. When the upper portions of the chord or the medulla oblongata become affected, epileptic attacks or convulsions occasionally occur, and even terminate existence, rather by the attending or superinduced asphyxia than by the amount of injury sustained by the brain.

152 *C.* The *prognosis* of palsy depends much upon the grade of severity, or the complete or general character of the malady, and upon its duration. In forming a prognosis, the circumstances alluded to when noticing the consequences and terminations of the disease should be taken into account. When the palsy is *local*, and independent of lesions in or near any part of the nervous centres, or where it is caused by any of the metallic poisons, hopes of recovery may be reasonably entertained. But when the disease depends upon organic change of these centres or of their envelopes; when it is complete and extensive; when a whole side of the body is affected; and when it has been of considerable duration, perfect recovery rarely takes place. I have met with this favourable result only in two or three cases. Yet, although perfect recovery so rarely occurs, the state of the patient may be ameliorated, and the patient may live many years without the occurrence of any of the unfavourable consequences or terminations of the malady, if a suitable diet and regimen be pursued. In all cases, the causes of the attack, and the nature of the antecedent disorders and attendant symptoms, should be considered. When the palsy is attended by great disorder of the digestive organs, when the urinary organs are remarkably affected (§ 57), and when the sphincters are relaxed, when spasms or contractions of the muscles are present, or convulsions supervene, and when the nature of the organic lesion implicating the brain, spinal chord, or their envelopes is manifestly such as cannot be entirely removed, the most unfavourable opinion may be formed of the result, although the ultimate issue may be deferred for a considerable time.

153. The *complications*, also, of palsy should influence the prognosis. The most unfavourable of these are the associations of hemiplegia with apoplexy or coma; with inflammation of the substance of the brain, as indicated by spasms, contractions, and pains of the limbs; with neuralgia of the nerves of the face or head; with epilepsy or convulsions; with insanity, imbecility, or idiocy; with disease of the heart or of the liver; with lesions of the cervical spine; and with inflammation of the kidneys. If the palsy supervene in the course of these, it may be generally assumed as the result of severe, if not irremediable, organic change in the brain or spinal chord.

154. Palsy of the muscles of articulation, of the tongue, or of deglutition, whether appearing alone or in connexion with hemiplegia, is a most dangerous state of the malady, and often precedes more complicated and severe forms of the disease, that will soon pass into fatal convulsions, or apoplexy, or asphyxia. Fully-developed *shaking palsy* is rarely materially ameliorated by treatment, although patients afflicted with it may live many years without much increase of the symptoms.

155. Recovery often takes place from the *hysterical* or *uterine complications* of palsy, although even in these the absence of all organic lesion of the nervous centres or of their envelopes ought not to be generally inferred, for irritation of the uterine organs, or suppression of the catamenia, may be followed by inflammation and its usual consequences in these parts, particularly in the spinal chord, or by congestion, especially of the venous sinuses of the spine, sufficient to produce interruption of the act of volition from the brain to the nerves of the extremities, owing to the pressure which such congestion may occasion.

156. Recovery from the less complete and least complicated states of palsy from the metallic poisons is sometimes brought about by careful treatment and suitable precautions and regimen. A case of complete hemiplegia consequent upon apoplexy caused by monkshood, respecting which I was consulted many years ago, quite recovered after a protracted treatment.

157. VII. Causes.—i. The *remote causes of palsy* are more strictly the causes of those maladies in the course of which alterations of the

nervous centres most frequently occur, and are so entirely the same as those which I have adduced in the articles Apoplexy, Epilepsy, Inflammation of the Brain, &c., as to require merely to be enumerated at this place.

158. *A.* The *predisposing causes* are chiefly hereditary predisposition, advanced age, the male sex, mental labour, luxurious habits, and sexual indulgences. I have observed a greater frequency of palsy in the children of those who have died of diseases of the brain than in others. Palsy is much less frequent in children and young persons, or in those under thirty years of age, than in persons farther advanced. According to the registrar-general's report, the deaths in the metropolis in two years from palsy were 33 under fifteen years of age, 614 from fifteen to sixty, and 932 at sixty and upward; and from the same authority it would appear that the number of deaths is as great in females as in males. Palsy is most frequently observed in persons whose habits are sedentary, and in those of feeble constitution. It is said to be more frequent in the sanguineous and nervous than in other *temperaments*; but this is not established. There can be no doubt of mental labour, depressed and anxious states of mind, luxurious habits, and venereal indulgences being most influential causes of predisposition to palsy. Indeed, the various circumstances which I have assigned as predisposing to Apoplexy (§ 77), have a similar influence in respect of palsy. Among these vascular plethora may be mentioned; and when this state is present, hemiplegia, either alone, or complicated with, or consequent upon, apoplexy, is the form of palsy most frequently observed.

159. Various *arts* and *employments* (see that article) remarkably predispose to palsy, especially all those in which lead, arsenic, and mercury are much used, as painters, plumbers, glaziers, &c., &c.; and in persons thus exposed, the disease occurs at earlier epochs of life than in other circumstances. It is least frequently observed in those who lead a sober and active life, and are much in the open air. It is rarely met with in sailors and soldiers, but this is partly owing to comparatively few of them being far advanced in life. The influence of the *seasons*, or of *weather*, in favouring attacks of palsy has not been shown with any precision; but cold and moist seasons and weather, and cold, humid, and miasmatous localities are certainly more productive of paralytic affections than other seasons, weather, or situations.

160. *B.* The *exciting causes* of paralysis are, 1st. *Physical, mechanical, and external agents*; 2d. The *mental emotions*; 3d. *Pathological states, or pre-existing lesions*; 4th. *Poisonous substances.* These may act (*a*) directly upon the ramifications or trunks of nerves; (*b*) or directly or mediately upon the cerebro-spinal axis.

161. *a.* Of the *physical agents* the most influential is certainly *cold*, particularly when severe in grade, or long applied to any part, or to the general surface. Cold directly depresses the nervous power, and benumbs sensation, thereby affecting the nerves themselves; it may also occasion congestion of the nervous centres, and particularly of the veins and sinuses of the spine, and, consequently, more or less complete forms of paraplegia, or general palsy, as in the cases already alluded to.* All applications to the surface of a part that conduct either the animal heat or the electricity from it may excite paralysis of it, particularly when long continued, as sleeping, sitting, or lying on the ground, or on stones; wet or damp clothes; the continued contact of metallic or earthen substances, &c. Pressure of any kind upon a nerve, whether produced by external substances or by tumours, abscesses, aneurisms, dislocations, or other lesions in the vicinity of the nerve, or by disease of the nerve itself, or of its neurilemma, and wounds, contusions, or other injuries of one or more nerves, are occasional causes of local palsy.† Causes of a similar kind, implicating the brain or spinal chord, especially depressions or displacements of the cranial or spinal bones; concussions or other injuries of the cerebro-spinal axis; depending or constrained positions of the head or spine; congestions, tumours, morbid depositions, or other changes in the nervous centres, their membranous envelopes, or bony cases, occasion hemiplegia, paraplegia, or general palsy, according to the seat of lesion as above assigned. To these may be added intemperance, fatigue, or exhaustion, changes of temperature and of the atmosphere, inanition, &c.

162. *b.* The influence of the *mental emotions* in causing palsy is undoubted; but it is not so directly manifested on the brain in all cases as may be at first supposed. The emotions, whether exciting or depressing, act primarily upon the heart and circulation, and through them upon the brain and spinal chord. Undue excitement of the imagination, sudden mental shocks, fits of anger, and venereal excesses, or masturbation, are not infrequent causes of palsy. Indeed, the several states of paraplegia and general palsy are oftener produced by the last of these causes, or by masturbation, than by any other.

163. *c. Pathological states*, or lesions occurring in the course of pre-existing disease, as already stated and sufficiently insisted upon, not only in this article (§ 34–53), but also under the heads Apoplexy (§ 34, *et seq.*) and Brain (§ 50, *et seq.*), are the most frequent and immediate exciting causes of the several varieties of palsy in their primary and associated forms. These, in fact, constitute the *chief morbid appearances* furnished by paralytic cases, and consist chiefly of exostosis, tumours, or morbid growths, in the cranial bones (see art. Cranium); tumours, effusions of blood, or of serum, fungoid productions, congestions, and the more common consequences of inflamma-

* The celebrated Scarron was deprived of the use of his limbs by prolonged exposure to cold during a fit of dissipation. His mental faculties were, however, unaffected, as in most instances of paraplegia, and of general palsy caused by lesion of the spinal chord. The fascinations of his wit were unimpaired, and he became the husband of the beautiful and witty Mademoiselle D'Aubigne, afterward the famous Madame de Maintenon. Scarron lived twenty-three years in a paralyzed state.

† [See an account of a peculiar form of paralysis in *New-York Journ. of Med.*, vol. ii., p. 34, by William P. Buel. It affected the nerves and muscles of the forearm, the hand, the thumb, and the fingers, producing loss of muscular power, and loss of sensation, partial or complete, from the bend of the elbow to the tips of the fingers. The cause is ascribed to long-continued pressure of the weight of the body upon the nerves of the forearm in sleep.]

tion of the membranes of the brain; congestion and inflammation, extravasations of blood, effusion of serum, abscesses, softening, induration, atrophy, ulceration, apoplectic cysts, tumours, tubercles, morbid or malignant productions, aneurisms, hydatids, watery cysts, sloughing or gangrene consequent on severe injuries in parts of the brain; effusions into the ventricles, or between the membranes; disease of the blood-vessels or aneurismal tumours, ossification of the coats of the arteries, varices or dilatations of the veins or sinuses, and coagula, or fibrinous, or other concretions in these vessels, are the chief lesions which have been found in cases of hemiplegia, and of partial palsy of the senses. The changes just particularized, affecting the spine, or the membranes or substance of the spinal chord, or medulla oblongata, are the usual causes of the spontaneous cases of paraplegia and general palsy, or those cases which occur independently of the more direct effects of external injuries. The occurrence of these forms of palsy in the course of caries of one or more of the vertebræ, owing either to the extension of inflammation to the membranes, to effusion of lymph, or of serum, or to pressure on the chord, owing to the acute angle formed by the consequent curvature, is sufficiently familiar to physicians. But *cancerous* or *malignant disease* of the vertebræ, consecutive of cancer of the mammæ, or occurring primarily in these parts, may also occasion paraplegia. Mr. Cæsar Hawkins has adduced three interesting cases of paraplegia from this cause, and my friend Dr. Abercrombie, of Cape Town, has communicated to me a similar case to two of those observed by Mr. C. Hawkins, which had occurred in his practice. In this instance, the breast was greatly enlarged, was quite adherent to the ribs, and its lower surface ulcerated. A prominence was observed in the situation of the second and third dorsal vertebræ, with tenderness on pressure; paraplegia, followed by its most unfavourable consequences, shortly afterward took place.

164. *Periostitis*, especially *scrofulous periostitis*, is not infrequently productive of partial palsy, and of paraplegia, or even of more general palsy, when affecting portions of the vertebral column. In these cases, as far as my observation has enabled me to state, the bladder is more or less paralyzed, the urine soon becoming alkaline, and neuralgic pains of the limbs are often present to a distressing degree.

165. *d.* Sufficient notice has been already taken (§ 100, *et seq.*) of the *poisonous substances* which occasion palsy. The slow introduction of mineral poisons, as lead, arsenic, mercury, &c., sometimes is followed by this effect; and in some cases, at least, their influence is exerted as much, if not more, upon the nerves supplying the paralyzed limb as upon any part of the nervous centres. The poisonous effects consequent upon the vegetable or acro-narcotic poisons are owing more to contingent lesions sustained by a part of these centres, while they and the circulation in them are under the influence of the poison, than to any effect produced by them on the nerves themselves.

166. VII. Of certain Points in the Pathology of Palsy.—It is obvious that palsy may arise from two distinct conditions of the nervous centres, viz.: 1st, from the *suppression* or *diminished evolution of the cerebro-spinal nervous power and of volition*, owing to interrupted circulation, to depressed vital influence, or to other alterations, in that part of the cerebro-spinal axis which is chiefly concerned in producing or originating that power; and, 2d, from *whatever may prevent the transmission of cerebro-spinal nervous power and volition* from the parts concerned in producing them to the limbs and organs which they actuate.

167. (*a*) If it be conceded that the gray substance of the brain and spinal chord be chiefly concerned in *originating volition and the other cerebro-spinal functions*, we may readily admit that, when this substance becomes manifestly diseased throughout the convolutions of the brain, a general state of palsy, more or less complete according to the extent of change experienced by it, may be anticipated; and this is actually observed in all cases where the gray structure is extensively changed, more particularly in those cases of general palsy complicated with Insanity, as shown in that article (§ 235). In these the cerebro-spinal functions—the emotions, intellects, volition, &c.—are more or less impaired, and the gray matter of the brain and spinal chord is generally found atrophied, indurated, or otherwise changed, and the structure especially concerned in the manifestations of these powers is no longer in a state capable of originating or developing them.

168. (*b*). *The transmission of cerebro-spinal nervous power and volition* may be prevented, although they are produced by injury, disease, or pressure of the medullary substance of the brain or spinal chord, or of the nerves. Most of the lesions adduced when describing the several forms of palsy and their efficient causes act chiefly by arresting or interrupting the transmission of volition; although, even in these or in other cases, many alterations of structure both interrupt the transmission, and prevent the evolution or the production of nervous power and volition; as when the lesion implicates both the gray and the medullary substance, both the origins and the course of certain nerves.

169. The well-known fact that disease on one side of the brain causes palsy of the opposite side of the body, has been attributed to the decussation of fibres in the medulla oblongata. This decussation was supposed to be confined to the anterior columns only. But, although it might account for the crossed paralysis of motion, it could not equally explain the circumstance of paralysis of sensibility following the same law. Sir C. Bell has, however, shown that the middle columns decussate as well as the anterior, and thus accounted for the crossed effect in both cases.

170. It has, moreover, been objected that lesions of the *cerebellum* also produce a crossed effect, although this organ is seated above the point of decussation; and that paralysis of the face follows the same law, and arises from disease in the opposite side of the brain, although the nerves distributed to this part also arise above the decussation. As to the first objection, it may be remarked that the dissections of Mr. Solly have demonstrated that numerous fibres run between the spinal chord below the corpus olivare and the cerebellum, which he believes to decussate with their fellows of

the opposite side, forming, in fact, part of the apparatus of decussation. But this discovery establishes merely a direct communication between the cerebellum and spinal chord in the immediate neighbourhood of the decussation, without proving the fact of the crossing of these fibres. As to the second objection, it may be answered in the words of Dr. Bennett, that Sir C. Bell has shown that the fifth pair of nerves arise below the decussation, and Mr. Solly has traced one of the origins of the *portio dura* from the fibres he has described, which run between the spinal chord and cerebellum. Thus the sensitive and motor branches of the face ought to follow the same law as the other spinal nerves, which is consonant with what actually takes place.

171. Cases have been recorded, however, in which paralysis has occurred on the same side as the lesions in the brain. Mr. Hilton has endeavoured to explain this exception by referring it to a disposition of fibres in the decussation; but, as Dr. Bennett has justly argued, there is strong reason for doubting whether disease in the brain ever causes a direct influence; for of the many thousand cases of cerebral hæmorrhage, tumours, &c., which have been recorded, we are acquainted with twenty-one only in which paralysis is said to have resulted from disease in the same side of the brain as the palsied side of the body, and, on analysis of these, more than one half are imperfect and doubtful. As the instances, therefore, of this occurrence are so few, may we not consider that the palsy even in them was produced in the usual manner, and that the lesion which attracted attention had no reference to the complaint? Numerous instances have occurred of abscesses, softening, and other alterations of the brain having been found, but in which no paralysis had been observed during life; and a still greater number are on record in which there was well-marked paralysis, but no appreciable lesion of structure after death. It is by no means improbable, therefore, as paralysis may be induced without leaving any traces, that, in those few cases where the palsy and the lesion in the brain were in the same side, it was really caused by undetected changes in the opposite hemisphere of the brain; and, as is sometimes the case, that the disease found in the hemisphere of the paralyzed side had not occasioned the loss of motion.

172. Lesions in the vertebral portion of the spinal medulla produce not a crossed, but a direct effect; and when they interrupt the functions of this part of the nervous system, all the parts furnished with nerves arising from beneath the seat of lesion are affected. Hence the paralysis is the more general, the nearer the disease of the chord is to the brain. But disorganization has sometimes gradually proceeded to a considerable extent in the spinal chord as well as in the brain, while such fibres or portions of the former as remained unaffected appeared sufficient to perform the limited extent of function which the state or exertions of the patient required. Cases have even been recorded in which individuals have performed voluntary movements of the lower extremities almost up to the time of death, and yet, on examining the chord, it has been found entirely destroyed. Such statements should, however, be received with distrust; for, although the presence of sensibility in the lower limbs may be explained in these circumstances (see § 181, *et seq.*), the transmission of volition, so as to act upon the extremities, cannot be accounted for. It is much more probable that the lesions observed had taken place chiefly after death, and had only commenced shortly before it; for the spinal medulla when inflamed, and even in health, often undergoes rapid changes after dissolution. We know, also, that when the spinal chord is inflamed, or is undergoing softening, involuntary, spastic, and automatic movements are produced in the muscles and extremities, that may be mistaken for voluntary motion, and it will hereafter be shown that, even when extensively diseased and incapable of transmitting the usual acts of volition, various reflected movements of sympathy may be made by the paralyzed limbs. Several cases have been recorded, where the spinal chord has been said to have been softened throughout, disorganized, quite diffluent, or even entirely divided, and yet sensibility, and even voluntary motion, have been preserved or but very slightly impaired. The case of Dessault, that recorded by M. Rullier, and others, are of this kind; but they are related with insufficient precision for implicit confidence, and they may, moreover, be explained as just stated, and thus furnish no basis of argument.

173. (*c*) *The physical conditions of the brain and spinal chord* ought to be taken into consideration in estimating the influence of lesions of these parts of the nervous system, or of their envelopes, in producing paralysis. These conditions are, 1st. The bony and unyielding cases enclosing them; 2d. The membranes interposing between them and these cases; and, 3d, The fluid interposed between the membranes, especially between the arachnoid and pia mater.

174. *α. The unyielding cases enclosing the cerebro-spinal axis* give rise to several accidents and changes consequent upon external injury, notwithstanding the influence of the membranes, of the processes of the dura mater, and of the fluid interposed between the membranes in preventing them. The pressure, laceration, &c., caused by fractures, depressions, &c., of portions of these cases; the concussions, counter-strokes, shocks, and succussions produced by falls on the back, shoulders, feet, and extremities; the direct pressure following the extravasation of blood, or of serum, the development of tumours, or venous congestion and interrrupted return of blood; the counter-pressure consequent upon these changes, and exerted chiefly on parts distant from, or opposite to, the seat of lesion or effusion; and the shock sustained by the vitality and nervous power of the frame, upon severe injury of the nervous centres, should all be taken into account when we attempt to explain resulting phenomena; inasmuch as they complicate the effects, and render their causes or sources more obscure and doubtful.

175. *β. The physical influence of the membranes* in preserving the nervous masses they enclose from injury and disease is obvious. They support, secure, and protect their contents; while they interrupt or prevent the extension of injury or disease from the external cases to the contained vital parts. Still, when they are

themselves the seat of disease, particularly of tumours or of inflammation, the pressure or irritation, or the extension of the disease and its more remote consequences, affect more or less the nervous centres and interrupt or disorder their functions, although the interposed fluid tends to prevent or to lessen these effects.

176. *γ. The cerebro-spinal fluid* interposed between the arachnoid and pia mater is not merely requisite to the healthy discharge of the functions of the brain and spinal chord, as shown by Cotugno, Magendie, and Todd, but is also most serviceable in preventing the extension of injury and disease from the bones and membranes enclosing these organs. The motions alone of the spine would be productive of serious consequences, if this fluid, which is more copiously interposed in this part of the nervous system, did not prevent them from materially affecting the chord itself, and the roots of the nerves which it transmits. When we consider the effects of this fluid upon the functions of the cerebro-spinal axis, it is impossible not to infer that the quantity of it will vary with the states of the nervous masses and of vascular determination to, or congestion of, them and their membranous envelopes. It may reasonably be concluded that, when these structures and the blood supplying them do not sufficiently fill the unyielding cases of the cranium and spine, the fluid interposed between the arachnoid and pia mater will supply the defect, and prevent the existence of any vacuum, and that, on the other hand, when the states of these centres and of the circulation in them are such as give rise to much fulness, the quantity of this fluid will be diminished. Anæmia will thus be attended by an increase of the cerebro-spinal fluid, and vascular turgescence by a diminution of it, the included masses being thereby preserved from much diminution of pressure in the one case, and from much increase of it in the other. Thus, also, in cases of atrophy, partial or general, of the brain or spinal chord, the quantity of this fluid is increased, showing the importance of it to the functions of these parts, while in cases of hypertrophy it is diminished or almost wanting.

177. It is obvious that in health the presence of a considerable portion of the cerebro-spinal fluid is always necessary to protect the nervous centres with which it is in immediate contact. It is very justly remarked by Dr. R. B. Todd, that by the interposition of a liquid medium between the nervous mass and the wall of the cavity in which it is placed, provision is made against a too ready conduction of vibrations from the one to the other. Were these centres surrounded by one kind of material only, the slightest vibrations or shocks would be continually felt: but when different materials on different planes are used, the surest means are provided to favour the dispersion of such vibrations. The nervous mass floats in this fluid, being maintained *in equilibrio* in it by its uniform pressure on all sides, and the spinal chord is farther secured by an additional mechanism, preventing its lateral displacement. The abundance of this fluid at the base of the brain and medulla oblongata protects these parts, the nerves, and vessels, from unequal or excessive pressure and counter-pressure during disease, or from accidents; while a diminution of it favours or even induces most serious consequences, as shown by the experiments of M. Magendie.

178. From what I have now adduced it may be inferred that the effects often imputed to the abundance of this fluid, particularly in the spinal canal, by several pathologists, when detailing the morbid appearances after death from diseases of the nervous system, have been imputed to a wrong source; that the serous effusion in these cases, as I have elsewhere argued, is neither the cause of pressure upon, nor of induration of, the nervous centres, nor the source of the palsy sometimes observed in these cases; but that it is a result of those changes of the nervous structure and of the local circulation with which it is found associated, in connexion with, or aided by, the unyielding state of the surrounding parts.

179. (*d*) *Of the Influence of the different Columns of the Spinal Medulla and Roots of the Spinal Nerves upon the Sensitive and Motor Powers.*—Since the researches of Sir C. Bell and M. Magendie on this subject, it has generally been supposed that, while the antero-lateral columns of the chord convey the motor power, the posterior transmit sensations. Several pathological facts, independently of the experiments of some physiologists, have, however, made it appear doubtful whether or not the power of motion and sensation are severally conveyed through these channels only, and in the precise manner just assigned. There can be no doubt, however, that volition is transmitted along the anterior columns of the chord, the anterior roots of the nerves and the corresponding nervous fibrils, to the muscles which are acted upon; and that sensation generally is conveyed in an opposite direction, namely, from the surface of the body along the sensory nervous fibrils, the posterior roots of the nerves, and the posterior columns of the chord, to the brain. But, although it seems satisfactorily proved that the acts of volition cannot be fully and precisely performed unless the channels by which volition is transmitted continue sound, or not materially injured, together with the corresponding portions of the fibrous structure of the brain, still it is very doubtful whether or not the posterior columns of the chord are as exclusively devoted to the conveyance of sensation as the anterior are to the transmission of volition. Indeed, the cases recorded by various writers, and especially those by Stanley, Webster, and others, prove either that the lesions observed in the posterior columns of the chord have taken place at the moment of, or immediately after, dissolution, or that sensation may be transmitted through other channels besides these columns, or even independently of the spinal chord itself. That the former of these alternatives cannot be the cause, at least to any considerable extent, is shown by the history of the cases and the nature of the changes which have been observed. It should, however, be admitted that, where softening of the chord is observed greater doubt may be entertained; for this change, when it has commenced before death, particularly as a consequence of inflammation, will often proceed and extend very rapidly immediately afterward, so as to be both complete and extensive at the time of inspection. Still, conceding all that may be inferred from this circumstance,

pathology furnishes sufficient proofs that sensations may be conveyed to the hrain by other channels in addition to the spinal chord, especially when the alterations in the chord, rendering it incapable of discharging this function, take place slowly or gradually.

180. Experimental proofs of the existence of these other channels, and evidence respecting them, cannot be furnished with the force of demonstration, as, however conclusive experiments performed on the higher animals with the view of furnishing such evidence may appear in the eyes of the experimenter, they will admit of other, and often very different, conclusions, and the phenomena observed in the lower animals, particularly those which cannot audibly express their feelings, may be ascribed to other causes, or differently explained. We can, therefore, in the present state of our knowledge, only infer from the history of diseases implicating the spinal chord, and from what we know of various inconclusive and not always truly or correctly observed experiments, that changes produced in parts or surfaces of the body may become objects of consciousness, in certain circumstances at least, without the intervention of the spinal medulla; hut as this cannot take place unless the sensation be transmitted by a different channel, it remains to inquire what that channel is, or whether or not various parts of the nervous system may, in certain circumstances, or to a certain extent, perform this function.

181. When we recollect that communicating branches run between the ganglionated or posterior roots of the nerves and the great sympathetic on each side; that ganglial nerves may be traced in their course from the sympathetic into the spinal ganglia and chord on the one hand, and from the latter into the sympathetic and ganglia on the other, we cannot but infer, not only that sensation may be transmitted, or, more correctly, that impressions on the surface may be conveyed to the brain, so as to excite consciousness, by a different route than that of the spinal chord, especially under circumstances of gradual change in the chord, rendering it ultimately incapable of discharging this function, but that this other route is through the sympathetic nerves and their communications with the posterior roots of the nerves and spinal medulla.*

182. The indirect character of this channel may appear an argument to some against the accuracy of this inference; but we know that, in cases of obstruction to the usual channels of circulation in the vascular system, very circuitous courses are developed in order to preserve an organ or limb, and the nervous system presents many points of analogy with that system, especially a transmission of sensation from the periphery of the body, and from the several organs and structures to the more central nervous masses, and a similar circulation or return of nervous agency in the form of motion and determinate muscular contraction. The analogy may be farther pursued, but the several points are so obvious that they require not even enumeration at this place. Moreover, it should be considered that, in respect of sensations excited in any of the abdominal or other viscera, it is very doubtful whether the spinal chord is the channel hy which the impressions or changes in the viscera are transmitted to the brain, or whether the sympathetic nerves and communicating branches between the ganglia are the courses which are pursued. Indeed, there appears little doubt of the latter being the actual channel of conveyance; for impressions on or changes in the viscera, especially those of digestion and assimilation, are as vividly and as rapidly conveyed to, and made objects of consciousness in, the brain, in cases of injury, or even of complete division of the chord, as in sound health.

183. The above considerations may serve as reasons wherefore sensation remains unimpair-

* [The following remarkable case would seem to prove that sensibility is entirely owing to the integrity of the spinal chord; and that, contrary to the opinion of our author, the intervention of the medulla spinalis is necessary to the transmission of sensations from parts below the seat of injury:

By an accidental fall, Mr. I. S. S. pierced the spinal marrow by a chisel one inch in width, which passed in to the depth of five inches in that space opposite the spinous process of the lower dorsal vertebra on the left side. The wound, at its superior extremity, was half an inch from the spinous process, and one inch at its inferior extremity; so that a line drawn parallel to the spinous processes of the vertebræ, and three fourths of an inch to the left, would have intersected it in the middle. The direction of the instrument was upward, at an angle from the surface of twenty to twenty-five degrees, and to the right of about twelve degrees, penetrating the spinal column, and undoubtedly entirely dividing the chord. The immediate consequence was total insensibility below the wound, with complete paralysis of the lower extremities, bladder, and rectum. The shock that the system received produced great prostration for some forty hours, when reaction took place, and was followed by fever for ten or twelve days. The urine was drawn off by a catheter for about one week after the accident, when the bladder began to resume its functions. For nearly the same period the bowels had to be relieved by enemata. Returning sensibility was experienced in the skin about the fifth day, and an imperfect use of the limbs about the fifteenth. The patient first commenced locomotion on his hands and knees, then by pushing a chair round, and afterward by means of crutches; but sensibility in the skin and power of motion in the inferior extremities returned very slowly, so much so that, four years and seven months after the accident, he burned his knee very severely, without feeling any pain or being conscious of suffering, by sitting too near a hot fire. Recovery eventually took place, without any curvature of the spine or spinal weakness, the patient being able to get into and out of a carriage and mount a horse without any assistance.

The case is an important one, as it goes to establish the fact that the spinal marrow is the sole channel for the transmission of sensations, and that it may unite, and its functions be restored, after complete division.—(*New York Journ. of Med.*, vol. v., p. 166.)

Two cases of fracture and dislocation of the spine, which have fallen under our care, were also attended with total loss of sensation and motion below the seat of the injury.

Dr. H. A. Potter relates (*N. Y. Journ. Med. and Collat. Sci.*, vol. iv., p. 174) the case of Mr. E., who was struck by the limb of a falling tree on the back, by which he was rendered insensible, with stertorous breathing, &c. He partially rallied from this state in about forty-eight hours, when it was found that there was no sensation nor motion below the upper part of the thorax. "The patient could not tell when he was pricked nor handled, unless moved so as to stir his neck; in that case the sensation was very great." "He continued for more than three months unable to move a finger or toe, or to tell, by feeling, when he was handled." At the end of this time, Dr. Potter, by a surgical operation, removed parts of the four inferior cervical and the two superior dorsal vertebræ. Four of the vertebræ were fractured so as to produce compression of the spinal chord. Ossification of the broken fragments had taken place. "Before the operation ended, the patient said he felt as though we were pricking him all over. Sensation appeared to return almost instantaneously, and for the first time that he was conscious of it, below the compression, after the receipt of the injury." In five hours afterward sensation was nearly perfect. The patient lived eighteen days after the operation, and died of disease of the lungs (*loc. cit.*). The opinion of our author, however, is doubtless correct, so far as it relates to those organs that are supplied with nervous influence by the ganglionic system of nerves.]

ed, or but little affected, in very many cases where the chord is diseased or injured so as to be incapable of transmitting the impulses of volition, particularly when the lesion is high in the chord, and when it has advanced slowly or gradually. They may also account for the rare occurrence of entire loss of sensation in any form of palsy of motion.

184. (*e*) *Congestion of the venous sinuses seated between the theca of the chord and the bodies of the vertebræ* has been already assigned as a pathological cause of palsy, or one of the most important changes upon which the paraplegic states of palsy depend. It seldom is found unassociated or alone after death and in the most complete states of the disease, as it generally superinduces more or less extensive changes in the chord and its membranes before dissolution takes place. Several of the more remote causes of palsy act by producing, in the first place, congestion of these *sinuses*, which were even imperfectly described by anatomists until M. Breschet directed more particular attention to their structure and connexions. But the pathological relations of congestion and of obstructions by fibrinous coagula or concretions in these sinuses have been entirely overlooked.

185. It will soon become obvious to those who make the early phenomena of disease objects of observation and study, that whatever depresses organic nervous power will soon be followed by venous congestion; and when this depression—whether primary or consecutive of nervous or vascular excitement—has been preceded or is attended by circumstances producing increased determination to, or fullness of blood in, the capillaries of the chord or its membranes, this consecutive congestion of the spinal sinuses is the more prone to occur. In its primary or uncomplicated states, it seldom produces more serious effects than pain, stiffness, or weakness of the back, loins, and lower extremities, sometimes amounting to incomplete palsy of motion of the latter; often with pain and constriction around the abdomen; and when the weakness or imperfect power of motion is associated with pain, this state is generally confounded with rheumatism or with neuralgia, if the pain is severe and follows the course of a nerve, or with an attack of gout, when it occurs in the gouty diathesis.

186. Congestion of these sinuses occasions, first, retarded circulation in the chord and its membranes; subsequently, an increased serous secretion or effusion between the membranes Unless the congestion be very great, it can hardly be expected that it should act injuriously on the chord by pressure, or counter-pressure of it against the posterior parietes of the spinal canal. Still, one injurious effect may be produced in this way, particularly when the congestion has superinduced distention of the capillaries of both the chord and the membranes, with increased serous effusion between the latter.

187. In these more extreme cases, when ulterior changes have taken place, it is not unlikely that *the roots of the nerves* will also suffer from unaccustomed pressure, and in those cases the posterior or gangliated roots are the more likely to experience it, and paralysis of sensation will be present in a greater or less degree, and even be the more complete, inasmuch as the lesion implicates those parts of the roots of the nerves which communicate with the sympathetic, as insisted upon above (§ 181). In cases, also, of caries and angular curvature of the spine, where not only congestion of the vertebral sinuses, but also pressure and counter-pressure of both the chord and the roots of the nerves, and even of the nerves themselves, as they pass through the spinal foramina, are apt to take place, palsy of sensation is then present, but only in degree proportionate to the extent of pressure on the roots of the nerves, and only in those cases where the nerves or their roots, especially the posterior, are implicated.

188. Congestion of the spinal sinuses, with more or less of the consequences now mentioned, is a frequent attendant upon *fevers*, particularly the more adynamic and congestive forms of fever, occasioning not merely pains and weakness of the back and limbs, and incomplete palsy of motion of the lower extremities, but also more or less of the affection of the urinary organs already mentioned (§ 57). Many of the cases described as spinal irritation, of hysterical neuralgia, of uterine irritation, &c., actually are instances of congestion of the spinal sinuses, occasioning remote or sympathetic phenomena in addition to those which are more strictly local. These are often removed or partially relieved for a time by the natural recurrence of the catamenia; but when more extensive or severe, or when associated with suppression of this discharge, they sometimes lapse into paraplegia or partial palsy, especially when neglected or injudiciously treated, owing to an increase of the congestion or of its consequences.

189. (*f*) *Various sympathetic phenomena occur in connexion with paralysis*, especially with the paraplegic states of the disease, that require particular notice. Some of these admit of different explanations, and thus have been differently accounted for, both by former and by contemporary writers. Of these, the *reflex motions*, which sometimes are observed upon irritating the surface of a paralyzed limb, have attracted most attention, and have directed the researches of physiologists more particularly than heretofore to the structure and functions of the *spinal chord*. These researches are fully noticed in the article on the pathology of this part of the nervous centres, with my opinions respecting them; and I therefore need no farther advert to them at this place than to remark that the phenomena which Dr. M. Hall has assigned to a reflex function of the spinal chord were fully recognized by Whytt, but not explained by him as occurring independently of sensation. He, however, believed that the power of feeling was not limited to the brain, but was extended to the spinal chord. Prochaska afterward more correctly appreciated the true source and relations of these phenomena; and in the articles Cholera, Chorea, Convulsions, &c., in this work, the characteristic symptoms of these maladies were explained, and ascribed to reflex actions excited in the voluntary muscles by irritations transmitted to the roots of the spinal nerves and spinal chord. Subsequently to the publication of these articles, Dr. M. Hall's researches appeared. He referred these phenomena to a special organization of

the chord; and his opinion received the support of Mr. Grainger, Mr. Newport, and others, although opposed by some eminent anatomists. The structure of the nervous system in the class *articulata* is the chief circumstance that can be adduced in favour of the existence of a spinal organization for reflex actions in the higher animals. But reflex actions—phenomena which I denominated, many years ago (1824), "*reflex sympathies*"—are performed not only by the spinal chord, but also by the *brain*, and by the *organic* or *ganglial nervous system*.

190. *a*. As respects the *brain*, no sooner are the impressions on the senses made objects of sensation or consciousness than they are reflected upon, or treasured in the memory, and, either instantly or at some future period, excite to action. The manifestations of life through the medium of an encephalon are the phenomena to which the term *mental* has been usually applied which consist chiefly of impressions on the senses, rendered objects of consciousness and of reflection by this organ, and which subsequently are recombined, compared, &c., and thus often become causes of volition. Many of the impressions on the senses are so strong as instantly to impel to action, without any intermediate state of reflection; or, in other words, the actions or volitions are so instantaneously consequent upon the impressions and impulses, that the intermediate reflections are not made objects of consciousness, or are not remembered. This is especially the case when the impressions on the senses excite the passions, and when the individual has been habituated to act upon them without allowing, or being capable of, intermediate reflection. These reflex actions, even when not directly proceeding from impressions on, or reports of, the senses, are nevertheless the results of such impressions or reports, received, remembered, or reflected upon at some antecedent period.

191. *β*. The reflected actions of the *spinal chord* may occur, as Dr. M. Hall has shown, independently of sensation, although sensation often attends, or is excited by the impressions which occasion them. They may even be so morbidly strong as not to be controlled by the will, when the individual is most conscious of their presence, as in tetanus. The reflected actions of the *ganglionic nervous system* are only objects of consciousness when they are excited by powerful stimulants or irritants.*

192. Thus there may be said to be *three classes of reflected actions*, viz.: 1st. That class of actions which may be denominated *psychical*, or *cerebral*, or which results either directly from impressions made upon the senses, or indirectly or reflectively from these impressions. 2d. That class which may be termed *animal*, or *spinal*, which proceeds from impressions or irritations transmitted to the spinal chord or roots of the spinal nerves, and is reflected thence by the motor nerves to voluntary muscles, and which may occur independently of the brain. 3d. That class which is *organic* or *vital*, which takes place in parts supplied only or chiefly by the ganglial system, and which is independent of both the brain and spinal chord.

193. *γ*. There are several circumstances connected with the *voluntary actions as involving consciousness*, to which farther allusions may be made. The actions which occur during sleep, when the mind is incapable of perceiving impressions made on the senses, unless they be inordinately intense, to which the terms *somnambulism*, sleep-waking, sleep-walking, &c., have been applied, are merely the result of suggestions arising out of previous or recollected impressions and reflections; these suggestions and reflections giving rise to volitions which excite the voluntary organs to action without awakening the senses, or permitting the perception of external objects in a distinct manner. Somnambulists may perform any of the common occupations of life, or may even execute difficult intellectual tasks with much ability. I have seen them compose, sing, play on musical instruments, &c., according to their respective tastes or occupations, and be still unconscious of the various surrounding objects of sense. Consciousness, however, of the act which the somnambulist is performing, and of objects connected with it, undoubtedly exists for the moment, to the abstraction of every other sensation. In this state, the suggestions, mental operations, and the resulting actions are often perfectly performed, as respects the ability of the individual; but, as they commence and are continued during a state of the brain unfavourable to sensation and perception, they are faintly, or not at all recollected. The concentration, also, of the mind on the subject engaging it, still more completely prevents other objects from being perceived. The somnambulist, in fact, *acts* his dream, and often in such a manner as to enable him to shun the dangers attending the action as completely as if he saw them distinctly, and thus avoided them. And yet there is reason for believing that they are not seen by him, but avoided from the circumstance of his having followed an accustomed and well-remembered track, each successive part of which is suggested to him as he proceeds, just as a person passes through a room in the dark, avoiding all impediments in his way from his recollection of their positions.

194. *δ*. Many of the above remarks apply to

* [Dr. B. Dowler, of New-Orleans, has recently attempted to disprove the theory of the reflex function by a series of ingenious experiments and reasonings, which may be found in the 6th vol. of the *New-York Jour. of Med.*, p. 305. These experiments fully establish the post-mortem contractility of the muscles, and that too, in many cases, for many hours after death. Dr. D. denies that experiments on the frog, and other inferior animals, are at all conclusive in establishing the complicated physiology of *man*: and he shows very conclusively that post-mortem contractility in the human cadaver has no connexion with, or dependance on, the spinal marrow. The following are selected from a large number of cases, illustrating the general phenomena of post-mortem contractility: "R. C., aged 25. In two hours after death, when the arm was extended to an angle of 45° from the trunk, and was struck with the hand, or side of a hatchet, it was carried to the epigastrium; but when the arm was extended upon the floor, so as to form a right angle with the body, he slapped himself upon the mouth and nose. The contractility began to decline in the third hour, and by the fourth hour all motions of the limbs ceased, although the pectoral muscles assumed the ridgy or lumpy form when percussed. An hour after death the thigh was moderately contractile. The leg hung down near the floor; its flexors, after being struck, drew up the heel against the buttock. Heat, for seven hours, from 101° to 102°. Five hours after death, contractility ceased, and rigidity prevailed."—*Loc. cit.*, p. 319.

Dr. D. also shows, from a number of well-conducted experiments, that the muscles possess the same power of contractility when entirely separated from the trunk, as in the arm and leg.]

dreaming, and in part also to the *motions of the body in sleep*. Dreaming may, or may not, be attended by movements of the body; but these are generally imperfect or partial, if observed at all, and have reference to the idea passing in the mind. In this case the mental suggestion either fails of exciting precise and corresponding actions and expressions, or excites them so partially or imperfectly as not to amount to somnambulism. The chief difference between dreaming and somnambulism is, that the individual during a state of sleep, or while the senses are closed against perception —or, rather, while the brain is incapable of perceiving the impressions made upon the senses in their usual states of intensity—not only dreams, but also actually executes what he dreams, without awaking from the state of which I have just defined sleep to consist.

195. But the motions of the body during sleep are often independent of dreaming, or of those sensations and suggestions which pass through the mind during sleep, and which are faintly remembered afterward; for obscure sensations may be excited for the moment by external objects or physical causes during sleep, although they are not at all recollected. A person turns or moves while asleep, owing to a feeling of uneasiness, which, although not remembered by him when awakened, has nevertheless been produced so as to cause the change of position. These movements have recently been adduced as instances of reflex actions occurring independently of sensation; but that momentary sensation has not been excited is not established. Even in experiments showing the occurrence of motion after the removal of the cerebral hemispheres, the non-existence of sensation is not demonstrated, inasmuch as sensation has not been proved to be limited to these hemispheres, nor even to exist in them; they have to perform other functions, of which the sentient principle, presiding, most probably, in some other part, as in the medulla oblongata or in its vicinity, takes due cognizance.*

196. *ε. Catalepsy* is a state altogether opposed to the foregoing—is the most complete

* The following observatione on the *Forms and Modes of Sensibility* were published in 1824, among my Physiological Notes, already referred to in various parts of this work. They may serve to elucidate many of the phenomena which occur in several states of paralysis.

The phenomena considered by several authors as evincing the existence of *sensibility* are referrible only to contractility, with which all classes of animals are endowed, and which, in the lowest orders and in some vegetables, assume the appearance of sensibility. In these latter, however, we have no reason to infer the presence of sensibility merely because they contract under the influence of a stimulus; for the contraction may take place without the existence of this property, from the effect produced by the stimulus upon the organization of the contracting part. Indeed, we cannot suppose that sensibility is present where the parts generally observed to be instrumental in its production are not found to exist. A sensation cannot be supposed to be produced where there is neither an organization suitable to receive, nor a channel to convey, nor an organ to perceive, an impression. We should, therefore, limit this term to those phenomena which the mind perceives or is conscious of when in a state capable of exciting perception or consciousness.

With this limitation, *sensibility* may be called the function of sensation, and a property peculiar to the animal kingdom. The sensations are derived through the medium of the senses, and of the nerves which communicate with the encephalic centre. On this centre the existence of sensibility chiefly depends, the ramification of its nerves, or the subordinate portions of it, being also parts of the appnratus requisite, but not giving rise to this property. As we ascend in the scale of creation, and as the senses and organs of volition present a more intimate connexion with this nervous mass—the encephalon—so sensibility becomes more perfect, until in man it reaches an extent greatly surpassing that of other animals.

In man, and perhaps in the more perfect animals, the *modes* of sensibility seem to vary. These modes may, however, be divided into *two conditions*, as they are more or less active, namely, *conscious* or *active sensibility*, and *inconscious* or *passive sensibility*: the former relates to those impressions, either from within or from without, which give rise to perceptions or ideas; the latter to those that are frequently produced upon the senses and upon the ramifications of the nerves, and, owing either to habit or the want of due attention to them, are not perceived by the mind. In this latter mode of sensibility, the organ receiving, and the channel conveying the impression, perform their offices; but the mind either is not, at the time when the impression is made, in a state to receive it, or receives it so imperfectly, from its weakness or its transient nature, as not to give rise to consciousness.

This mode does not necessarily imply a difference in the degree of sensibility, but the condition in which this property exists, owing either to its being more excited by other impressions, or to its being exhausted at the time when the impression is made. This condition is one to which the highest manifestations of sensibility as well as the lowest may be occasionally subject; it is, however, merely a relative mode of this property; and the relation subsists entirely between the state of the cerebral organ which perceives, and the force and duration of the impression made upon the organ of sense. Thus, when the sensibility is actively occupied with a particular object, and an impression is made at the same time upon a different organ from that through which the perception with which the mind is engaged was conveyed, the second impression may affect the senses in an evident manner, and even so as to influence volition, yet we may be unconscious of its operation, and no active perception may result from it. If, however, the second impression be stronger or more vivid than the first, or if, from various other circumstances, it should excite the cerebral functions, active sensibility or consciousness is the result.

As sensibility, according to this view of the subject, is, in its active state, a term merely expressive of consciousness; and as this faculty is evidently dependant upon the cerebro-spinal nervous system, especially on that more complex part of it which holds relation with surrounding objects; and, also, as we have no reason to attribute the possession of this part of the nervous system to the very lowest orders of animals, particularly to the class Radiata, so we must conclude that, although sensibility is a property of animal life, its higher grades are not possessed by all animals. It may be also stated, that *active* sensibility, being thus considered as expressive of, or comprising consciousness of sensations, and of the intellectual and moral operations, varies in its extent throughout the animal kingdom according as those manifestations are more or less numerous and perfect. How far the *passive mode* of sensibility, or that unattended by consciousness, may be a property of the lowest orders of animals, is difficult to say. We may, however, infer, that as this latter condition of sensibility may take place without an active exertion of this property in the highest animals, so it may result from a less perfect endowment of sensibility in the lower; and as this mode may require a less complex apparatus for its production, inasmuch as its relations are more simple, so it may be possessed by animals whose organization and manifestations do not permit us to conclude that they are capable of evincing sensibility in its more perfect and active conditions. The relations which this form or mode of sensibility holds with the numerous instincts of animals must be evident to all who consider the subject. The relations, however, which evidently subsist between that form of sensibility called *organic sensibility* by BICHAT, and the animal instincts, are much more numerous, more intimate, and more apparent.

Organic sensibility refers to those sensations which are produced in different degrees of intensity, owing to the existence of certain conditions of those viscera which are immediately subservient to the preservation of the individual and the species; to nutrition and reproduction, and which are not immediately subjected to the influence of volition. The conditions of the parts exciting organic sensibility are very various, and are the result of irritations arising from the presence of a stimulus, of unnatural actions supervening in particular systems or textures, and of the deficiency of that stimulus or influence to which particular viscera have been accustomed. Many of the changes preceding this class of sensations seem to interest, in the first instance, the ganglial class of nerves; but, owing to the intimate relation subsisting between this part of the nervous system and the voluntary or sentient part, the impression or change is propagated to the brain. This is the only essential difference which exists between this and the other forms of

and general state of palsy of motion that can exist without terminating existence; but it rarely continues longer than some hours, although it may recur after short intervals, lasting on some occasions for many hours. In this state, the muscles of voluntary motion—even those of the face and the eyelids—will not contract upon irritating them, nor will they be influenced by the will of the patient, which is generally attempted to be exerted when consciousness is not altogether abolished. The sensibility, indeed, is generally not lost during the attack, although it is more or less obscured in most cases. In a patient who is liable to attacks of this complaint, and whom I have often seen during their continuance, the eyelids and all the voluntary muscles retain the positions in which they are placed, but not the least appearance of contraction is manifested upon the most energetic irritation. Still, this lady feels, sees, and hears during the continuance of the seizure. She even wills the action of the muscles, but volition is not transmitted to them. The voluntary muscles of respiration are generally the first to act upon the return of voluntary power. In another case which I had an opportunity of observing during the attack, the sensibility was somewhat more diminished than in the foregoing; but I have not met with an instance of its entire abolition. The sphincters are always unaffected in this disease. The respiratory movements are slight, and perceived with difficulty; the impulse of the heart is weak, and the pulsations generally accelerated and soft, but sometimes slow or irregular.

197. (*g*) *Mechanism and Functions of the Spinal Chord.*—There are other phenomena besides those already mentioned, which occur in paralyzed limbs, and which deserve a brief notice at this place. Dr. M. Hall and Dr. Budge have shown that, in cases of paraplegia where sensibility as well as motion is lost, convulsive motions are produced in the paralyzed limbs by tickling the soles of the feet, and even on defecation and micturition. But it is doubtful whether sensibility is entirely lost in these cases, the occurrence admitting of explanation in the manner stated above (§ 181, *et seq.*), and still more readily, if the minute anatomy of the spinal chord, according to the researches of Stilling, Van Deen, and Budge, be taken into the account. The chord, according to these researches, consists, first, of perpendicular fibrils, forming the white substance of it; secondly, of transverse fibrils, and of very delicate longitudinal fibrils, constituting the cineritious or gray substance of the chord, the traverse fibrils crossing at right angles, and forming a network with the longitudinal both of the gray and of the white substances; thirdly, of corpuscles, of an angular form, with nucleated or projecting processes, scattered in groups through the anterior gray matter only, and most numerous at the origin of the anterior roots of the nerves; fourthly, of transverse fibres, passing directly from the posterior to the anterior gray substance of the chord.

198. The roots of the nerves are direct prolongations of the gray substance. Fibrils pass from the gray, through the white substance, into the roots of the nerves. Dr. Stilling traced fibrils from the posterior roots to the anterior gray masses; and fibrils, almost as soon as they enter the chord, run between bundles of fibrils of white substance to join other bundles of fibrils from adjoining nerves. Others, in fasciculi, form loops with fibrils coming from the next nerve; and others appear as continuations of the transverse ray-like fibrils of the posterior gray substance, while the connexion of the anterior roots with the anterior gray substance is still more distinct. The nucleated processes, or corpuscles of this substance, are in immediate connexion with the primitive fibrils of the roots of the nerves.

199. The afferent properties of the posterior, and the efferent properties of the anterior divisions of the chord, are rendered more manifest by the above results, at which the abovementioned anatomists have arrived. But, according to Dr. Stilling's experiments, the longitudinal fibrils of the anterior white substance do not transmit volition to the nerves, this office being performed by the longitudinal fibres of the anterior gray substance. As the transverse fibrils are prolonged into the nerves, and as we know that the posterior nerves are necessary to sensation, so it may be inferred that the posterior transverse fibrils are excitors of the posterior longitudinal fibres of the gray substance, and that a sensation, or rather the sensative impression, is transmitted by the posterior transverse fibrils, and by the longitudinal fibres, to the sensorium; the same relations, *mutatis mutandis*, being conceded to the anterior gray fibres. As centripetal impressions pass from the sensitive nerves along the transverse and longitudinal fibres of the posterior gray substance to the brain, so centrifugal impressions may pass in a contrary direction, that is, from the brain along the longitudinal and transverse fibrils of the anterior gray substance to the roots of the motor nerves.

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sensibility. It is the brain which perceives in them all; and although stimuli, or the defect of stimuli, may give rise to certain phenomena possessing the characters of the higher manifestations of this property in the organs appropriated to the preservation of the organic system, independently of the sensorium, consciousness, or the more perfect form of sensibility, cannot form part of the results.

Organic sensibility may also be *active* or *passive*; it may or it may not be attended with consciousness; and even the unconscious mode of it may indirectly impel to action, or give rise to many of the manifestations or instincts which characterize the lower animals, owing to the ganglial centres, either from their organization or connexions, or from both, performing a greater extent of function than usually falls to their share. If, therefore, the passive form of organic sensibility may propel to action without consciousness, or the sensorial sensibility being excited in those animals, we may also account, in the same manner, for many of the instinctive functions being performed when we cannot trace them to the influence of a cerebral organ. Of all the conditions of sensibility, the active organic form is the least under the control of the mental powers. It also, in all its modes of existence, more intimately interests the existence of the individual than the other forms of sensibility; organic sensibility involves a feeling in all its active manifestations instinctive of life or death.

From this it will be readily seen how close a connexion exists between organic sensibility and the animal instincts; it does not, however, belong to my plan to trace the connexion in all its relations.

Of sensibility generally we may observe that, in the human species, it is very variable, even in health; in some persons it is very much exalted, in others very obtuse. It is vivid in early life and in youth; after the age of manhood it gradually diminishes; as old age advances it decreases rapidly; and in persons who have attained a greater age it is present in the lowest grade in which we find it in the species. Its morbid conditions—in respect both of grade and kind—form or characterize many of the most important diseases of the human economy.

200. Such being the mechanism of ordinary sensation and motion, according to the recent researches of Stilling, Van Deen, Budge, and others, it can be no longer difficult to account for those involuntary movements which are produced in a paralyzed limb when the surface of it is irritated, pinched, or tickled, and which have been termed by Dr. M. Hall reflex actions, depending, according to him, upon a reflex function of the spinal chord, which function he refers to a distinct mechanism in the chord. It has already been contended by the author that no such mechanism exists, and that these actions are sympathetic, and result from the conformation of this part of the nervous system, transverse fibrils passing, as shown by the anatomists just referred to, directly from the posterior to the anterior gray substance, to convey impressions from the sensitive fibrils, and to excite the roots of the motor nerves. That no appropriate and peculiar structure exists in the chord for the purpose of performing these sympathetic or reflex movements, beyond what has now been noticed, is the opinion not only of the author, but also of the writers already mentioned, as well as of many others who have investigated the subject.

201. Dr. M. Hall has contended that the spinal chord is the source of muscular irritability, and that this irritability is exhausted by volition. In proof of this position, he states that paralytic limbs are more readily agitated by galvanism and strychnine than sound limbs when the cause of palsy is in the brain, the paralyzed muscles being in such cases more irritable than natural, while they are less irritable when the palsy proceeds from the state of the chord. The irritability is thus considered to be increased in the former case, owing to its not being exhausted by volition, and to be diminished in the latter, owing to the lesion affecting its source. But experience shows the inaccuracy of this inference, for the paralyzed muscles, in cases of cerebral paralysis, are not more irritable than the sound muscles, but, on the contrary, less so, as tested by Voltaic electricity; and Dr. Pereira has come to a similar conclusion. In the article Irritability, I have adduced my views, as promulgated many years ago, respecting the source of this property—have stated that it proceeds from, and depends upon, the organic or ganglial nervous system; and have contended that it does not arise from the spinal chord and nerves, although it is rendered more energetic and perfect in the voluntary muscles by the supply of nerves which they receive from the chord. The truth is, that the tone, rigidity, and irritability of all paralyzed muscles are more or less impaired, the less so when the lesion is in the brain and high in the chord. Still it cannot be doubted that strychnine or nux vomica affect these muscles more readily and more remarkably than the sound muscles. These facts may be explained partly by referring to the minute structure of the chord, and partly by the circumstance of this substance being rapidly absorbed and acting energetically on the structure of the chord and origins of the spinal nerves.

202. The fact that mental emotions often excite parts which are paralyzed is also explained by the mechanism of the chord, and by the circumstances so strongly insisted upon by Bichat, but since so much overlooked, that mental emotions powerfully affect the ganglial and sympathetic nerves, and, through them, the spinal chord and the nerves proceeding from it, the sympathetic nerves communicating freely with the chord and roots of the spinal nerves, and contributing numerous fibrils to the latter to be distributed with them to the parts they supply.* That volition, when continued or energetic, exhausts the irritability of voluntary muscles, is admitted, and hence the sense of fatigue, lassitude, and even of soreness or pain, which often follow such exertion.

203. (*h*) *The relaxation of the sphincters* occasionally observed in palsy, especially in paraplegia and general palsy, has been viewed as a phenomenon of more general occurrence than it really is. The fact is, that the sphincters are not so frequently relaxed, as they are imperfectly influenced by the will, or are not at all affected by it. They still retain much of their tonicity, but volition is not so energetically exerted on them as to counteract the actions of the hollow viscera when these viscera are excited by an accumulation of their respective contents, or by medicine. The *tonicity* or power of the sphincters has been attributed entirely to the spinal chord, and without reference to any influence they may derive from the organic or ganglial nervous system. But although they derive a share of their power, more especially the voluntary increase of power, as circumstances may require it, from the cerebro-spinal axis, their continued state of tonicity is chiefly to be attributed to the organic system of nerves. This is shown in paraplegia and in general palsy, in both which the sphincters very often retain a natural condition of contraction; but that contraction is frequently not increased by volition so as to resist the action of the bowels or urinary bladder. In some cases of these states of palsy, the sphincters are not much affected, especially when the palsy is incomplete, or seated high in the chord. Pathological evidence, indeed, clearly leads to the inferences, 1st. That the power of the sphincters is attributable chiefly to the organic nervous system, but that it is increased by volition exerted through the medium of the spinal nerves, especially in circumstances requiring such increase, as when the disposition to the actions of the bowels or bladder has to be resisted; and, 2d. That it is chiefly this latter influence, or that which is exerted through the spinal chord, that is either lost or impaired, in cases where the voluntary contractions of the sphincters are insufficient to prevent the passage of the excretions when the patient wishes to retain them. It is not, therefore, to be inferred that where there is insufficient control over the evacuations, the sphincters are either relaxed or ma-

* The views published by the author in 1822, in the *London Med. Repository*, and, in 1824, in his *Physiological Notes*, &c., respecting the independent and distinct constitution of the organic or ganglial class of nerves, as to the functions and relations of this part of the nervous system, and as to the influence exerted by this system on the vascular system on the one hand, and on the cerebral system on the other; in short, the positions thus taken, from researches in various classes of animals, that all organs and parts which are necessary to the life of the individual animal, and to the perpetuation of its species, are supplied by ganglial or organic nerves in proportion to the importance of each organ, and to the activity of the several organic processes, have been recently fully confirmed by the researches of Stilling, Bidder, Volkmann, Wallach, Hannover, R. Lee, and others.

terially deficient in power; but that they are only insufficiently influenced by volition, relatively to the power which overcomes their natural tonicity.

204. VII. Treatment of Palsy.—There is no disease which more requires an intimate study of its nature and relations before a determination should be formed as to its treatment than the one now under consideration. The seat, grade, pathological condition, and constitutional peculiarities of paralytic maladies are so diversified, that each case should be made a separate study, and such means only as are appropriate to existing pathological conditions ought to be employed. I shall endeavour, 1st. To point out the plans of treatment which are most serviceable in the principal forms, states, and complications of palsy; and, 2d. To appreciate the character and value of the numerous medicines and methods of cure which have been recommended for this disease, and their applicability to the several conditions in which it comes before the physician.

205. i. Of Paralysis of Sensation.—The means to be employed in this form of the disease should be selected with strict reference to the remote causes, to the pathological conditions inferred to exist in each case, and to the particular circumstances of the individual. If this affection occur in a spare habit of body, if it be unconnected with general or local vascular plethora, and if it have been caused by cold or other depressing agents, the means about to be recommended for the more chronic states of paralysis of motion (◊ 213, 214.) may be employed, especially local stimulants and irritants, internal excitants, external derivatives, galvanism, &c. In all cases, however, the strictest attention should be paid to the several digestive, secreting, and excreting functions.

206. If the *senses* of *sight*, *smell*, or *taste* are singly or generally affected, the same principles of treatment should be adopted as are here espoused in respect of *anæsthesia*; the several means being selected or modified according to the peculiarities of the case, and the organ especially disordered.

207. Local congestions are concerned in producing many, probably the majority of cases of *anæsthesia*. If the loss of feeling be associated with hesitation or other affection of the speech, these conditions may be more confidently inferred; and if the anæsthesia be hemiplegic, a limited congestion, hæmorrhage, or softening of some part of the brain probably exists. When anæsthesia occurs in plethoric and robust habits of body, in persons who have lived fully, or of sedentary habits, or consecutively of suppressed evacuations or discharges, then these pathological states most probably exist, and the affection, if not quickly removed, will often soon be followed by paralysis of motion. In these circumstances, the treatment advised for the acute states of palsy of motion, especially general and local vascular depletions, cholagogue and other purgatives, and derivatives, is that which is most appropriate. Subsequently, external excitants, as sinapisms, vesicants, urtications, &c., or the other means noticed for the more chronic states of palsy (◊ 213, *et seq.*), may be prescribed. When anæsthesia is associated, as it generally is, with loss of motion, the treatment is in all respects as about to be stated with reference to palsy of motion, which is then the most important phenomenon, and the one which should chiefly engage attention as respects its immediate cause.

208. ii. Treatment of Palsy of Motion, &c.—When the faculty of motion is paralyzed either alone or conjointly with partial or more complete palsy of sensation, the treatment should be directed with the same intentions as have been just mentioned, viz., 1st, with the view of removing the morbid states or the structural lesions inferred to exist in each case which may present itself; and, 2dly, with the object of restoring the transmission of nervous influence to the paralyzed muscles.

209. *A. When the palsy is strictly local or partial*, the treatment should necessarily depend upon the peculiar features of the case. In this state of the complaint (◊ 21) the lesion may be either in the origin or in the course of the nerve supplying the paralyzed muscles; but it may also be limited to the ramifications of the nerve, as when the affection is caused by the continued influence of cold, &c. If the lesion be inferred to exist at or near the origin of the nerve, local depletions, derivatives, alteratives, especially a carefully regulated course of mercury or of the iodides, with sarsa, &c.; external irritants and drains; and a due promotion of the several secretions and excretions, comprise the most efficient means of cure.

208. If the nerve have its functions interrupted by changes in any part of its course, as by thickening of the periosteum, by abscesses, tumours, &c., alteratives, particularly the iodides, with the solution of potash and sarsaparilla; various external applications, particularly the tincture of iodine, or solutions of the iodides, the plaster of ammoniacum with mercury, &c., and other means suited to the nature of the case, may be resorted to, if the ramifications of the nerve be chiefly affected; and particularly if colds have been the cause of the disorder, sinapisms, blisters, or applications containing capsicum or mezereon, may be prescribed, and if these fail, the part may be stimulated by either of the means hereafter to be mentioned (◊ 249, *et seq.*).

210. *B. The hemiplegic form of palsy*, whether occurring *primarily* and *simply*, or *associated* with apoplexy or convulsions, or appearing *consecutively* of these, is the most common form of the disease, and requires the greatest discrimination in estimating the pathological changes and in prescribing the means of cure. —*a. In the acute or early period of the malady*, prompt and decisive measures are generally required; yet these should be varied according to the mode of accession and character of the attack, as already noticed (◊ 35–40). If the complaint approach in the *gradual manner* above noticed (◊ 35, 36), alteratives and derivatives are chiefly indicated with the view of removing or arresting the lesions which may be inferred to be the causes of the complaint, and of allaying the irritation they may be supposed to occasion. Local depletions, especially by cupping on the nape of the neck; sinapisms or blisters in this situation and behind the ears; purgatives and alteratives; setons in the nape, and mustard pediluvia, are severally indicated. In this form of palsy, vascular depletion, unless local and moderate, is seldom of much service.

Purgatives are generally required; and mercurials, in alterative doses and combinations, especially Plummer's pill with soap, or the bichloride of mercury, in small doses, taken either soon after a meal, or with preparations of sarsaparilla, sometimes either ameliorate the symptoms, or arrest for a time the farther progress of the disease. It is in this form of hemiplegia that the iodides are more particularly indicated. I have given the iodide of mercury, or Plummer's pill, nightly, and the iodide of potassium, with solution of potash and compound decoction of sarsaparilla, during the day, with manifest advantage, a seton being kept open in the nape of the neck.

211. When the attack of palsy seems consequent upon *inflammatory softening of a portion of the brain*, &c. (§ 37, 38), local vascular depletions, or even general blood-lettings, are manifestly required. Active purgatives and mercurials are also requisite; and, in the intervals between the exhibition of purgatives, the bichloride of mercury should be given in small and frequent doses, until the gums become affected, external derivation being also produced by the usual means, while the head is kept cool and elevated. In this form of the disease, I have not seen any advantage accrue from the iodides, especially in the *early* or *acute stage*, or while inflammatory action continues to exist. In other respects, the treatment in this variety of the disease should be conducted as advised for inflammation of the brain. (*See art.* Brain, § 191, *et seq.*)

212. If hemiplegia occur in a *sudden manner* (§ 39), the treatment should be as prompt and energetic as in cases of apoplexy. In many cases, particularly in robust and plethoric persons, copious general or local blood-letting, or both general and local, is required; and either one or the other, or even both, may be again necessary some days after the accession of the attack, owing to the vascular reaction consequent upon it and the previous depletions, or attending the inflammatory action produced by the extravasation of blood causing the seizure. In this form of palsy the pulse should be carefully watched during the first fourteen or twenty-one days after the accession of the symptoms; and as soon as it acquires fulness or hardness, blood-letting, according to the circumstances of the case, should be repeated. But, in order to prevent the necessity of recurring to depletions, purgatives, external derivatives, and refrigerants or cooling diaphoretics, should also be prescribed at the commencement of the attack. In this variety of the disease I have seen much benefit derived from the bichloride of mercury, either alone, and taken soon after a meal, or with sarsaparilla, until the system became affected by it; but vascular depletions should be premised, and the secretions and excretions duly promoted. In this state of the malady, as well in that which is *associated with*, or *immediately follows*, *the apoplectic seizure* (§ 40), the treatment in the early or more acute stage is in every respect similar to that which I have recommended in the article *Apoplexy*, when that malady is attended or followed by hemiplegia. (*See art.* Apoplexy, § 146, *et seq.*)

213. *b. The chronic or persistent state of hemiplegia* is seldom altogether removed. The injury received by the fibrous structure of the brain, in the great majority of cases, is such as admits not of the restoration of the complete power of volition over the paralyzed limbs In this state, setons or issues may be tried; but they should be kept discharging for many weeks before much advantage can be expected from them. At the same time, the iodides, particularly the iodide of potash, may be exhibited either alone or with liquor potassæ, or as already recommended; and the bowels should be kept freely open by means of chologogue purgatives.

214. During this period of the disease, various internal and external stimulants and irritants have been advised, with the view of accomplishing the *second indication of cure* (§ 208); but the selection of them requires great discrimination as regards their respective properties and the existing pathological conditions. The preparations of nux vomica, strychnine, &c., have been recommended in this state of hemiplegia, but I have rarely or never found them of service in this form of palsy; but, on the contrary, productive of more or less mischief, especially whenever increased determination or fulness of blood in the head was present. They are indicated only when an opposite state of the cerebral circulation is inferred to exist, and in some other forms of the disease. The same may be said of the use of other internal stimulants, when a disposition to increased vascular action or effusion exists in the substance and membranes of the brain; for in such cases the preparations of iodine, aconite, cantharides, serpentaria, phosphorus. camphor, electricity, galvanism, &c., of which more particular notice will he taken hereafter, are very rarely of use, but often injurious. The remarks which I shall have to offer respecting certain modes of cure, and various medicines more or less praised for this complaint, apply so entirely to this period of hemiplegia, that I shall add no more at this place as to the means which may be farther employed in the treatment of it.

215. *C. The treatment of paraplegia* so entirely depends upon the nature of the lesion producing this form of palsy, that a continual reference to such lesions must be had in the observations which I shall have to offer on this subject. I have stated above (§ 53) the several changes causing paraplegia; and it will be seen that these require a treatment appropriate to each individually.—*a.* It is obvious that the means required for paraplegia consequent upon *concussion* or *fracture* of the spine, or upon *laceration* of, or *pressure* on the chord by displaced bone, are chiefly surgical at an early period; and that the selection of these means should depend upon the peculiar features of the case, and the extent of local injury. At a later period, when the palsy still continues, the treatment will necessarily hinge upon the physical condition of the parts, and the presumed consequences of the lesions immediately resulting from the injury. In such cases the paraplegia sometimes persists, although the physical condition of the spine appears but little or not at all altered. In these it may be presumed that softening, effusion, or some other consequence of inflammatory action is present in the chord or its membranes; and, consequently, these cases come under the same category as others about to be considered (§ 216).

216. *b.* In cases of paraplegia which commence with severe pains or tenderness in the spine or loins, or with a sense of heat or burning, followed by spasms, numbness, and loss of power, indicating an *acute* or *inflammatory character* (§ 56), a decided antiphlogistic treatment is requisite, especially at an early period. In these, cupping on each side of the spine near the seat of pain or tenderness, repeated according to circumstances, mercurial purgatives and terebinthinate enemata, are the most efficient remedies, especially when these symptoms have not been of long duration. If pain or spasms still remain after a due recourse to these means, calomel, or other mercurials, should be given with opium until the mouth is slightly affected, attention being paid to the states of the urinary bladder and bowels, and of their excretions.

217. In cases of paraplegia of a more insidious character—in those which occur gradually and slowly, or which are consequent upon exposure to cold, or are attributable to congestion of the spinal sinuses, to increased serous effusion, or to chronic lesions affecting the chord, or to scrofulous changes in this part, its envelopes, or vertebræ, the bichloride of mercury as exhibited above (§ 211, 212), or conjoined with the compound tincture of bark; or the iodide of potassium with liquor potassæ and the fluid extract of sarsa, or an alternation of these; stomachic purgatives, warm salt-water baths followed by active friction of the trunk and limbs, and strict attention to the excreting functions, and to the states of the discharges, are the measures which have proved most beneficial in my practice. The bichloride of mercury, or Plummer's pill, should be exhibited until the gums are affected, or until recovery takes place; and, when the motions are tar-like, and are procured with difficulty, calomel should be given with active cathartics, such as the compound extract of colocynth, scammony, &c., sometimes quickened with a drop of croton oil. Blisters, or rubefacient applications, may be placed on the back, and be repeated according to circumstances The *liniments* prescribed in the *Appendix* (Form. 308, 311) may be applied as *embrocations* in the course of the spine, from time to time, or be rubbed assiduously in this situation.

218. Setons or issues on each side of the spine have been advised, and in some instances have proved serviceable, particularly when aided by a judicious internal and constitutional treatment, but they require discrimination in respect both of the pathological causes of the paraplegia, and the general health of the patient. When the disease appears to have proceeded from exhausting causes, as masturbation, venereal excesses, &c., or to have been aggravated by these, then setons or issues are generally injurious, especially when the constitutional powers are much exhausted. Stimulating and invigorating measures are required in all such instances. In these and similar cases, I have found the tincture of the sesquichloride of iron with the tincture of cantharides; the compound galbanum pill with the sulphate or oxide of zinc; the aloes and myrrh pill with the resinous extract of nux vomica; and the valerianate of zinc lately introduced by Mr. J. Savory, of more or less service. Sir B. Brodie recommends a grain of sulphate of zinc to be given three times a day, increasing the dose, and to be washed down by a draught containing twenty minims of the tincture of cantharides. In cases of this nature, the preparations of iodine, particularly a weak tincture, or the compound tincture of the pharmacopeia; or small doses of the bichloride of mercury in the compound tincture of cinchona and tincture of capsicum, or an alternation of these, have been of essential benefit. Sir B. Brodie takes favourable notice of the bichloride of mercury in doses of one sixteenth of a grain three times a day, with a moderate dose of the tincture of cantharides. I have tried this mode of exhibiting the bichloride, but the effects should be watched. The compound tincture of camphor will be conjoined with these two medicines with advantage.

219. *The treatment of general paralysis* in most instances is much the same as that just recommended for paraplegia; for the former generally depends upon similar lesions to the latter, or is merely an extension of it.—*a.* When the general palsy is a symptom of the more violent states of *apoplexy*, the means appropriate to these should be prescribed (*see art.* Apoplexy, § 135, *et seq.*). When it is the result of *concussion* of the brain, or of the spinal chord, or of *fracture* or other *injury* of the cervical vertebra, the treatment must depend upon the violence of the shock, on the presence of the primary symptoms, or the supervention of reaction—on the state of the heart's action and of the circulation, both locally and generally, and on various circumstances which will influence the experienced physician. The intentions of cure should, therefore, be not only varied, but different, or even opposite in different cases and circumstances.

220. *b.* In cases of general palsy from *caries* of the cervical vertebra, after the acute symptoms have been removed by local depletions, blisters, mercurials, &c., issues, setons, or moxas, &c., should be placed a little distance from the seat of lesion; and an embrocation, consisting chiefly of the compound camphor and turpentine liniments, placed from time to time along the spine. In the case of caries of two of the cervical vertebra referred to above (§ 68) the treatment consisted of active mercurial and other purgatives, of an alternation of a short course of the bichloride of mercury dissolved in the compound tincture of bark, with a more prolonged course of the iodide of potassium and solution of potash, with the fluid compound extract of sarsa. A protracted discharge was procured by means of blisters and savine ointment, applied to each side of the neck just below the occiput. The recovery has been complete. The neck, however, is shorter and much stiffer, obviously owing to absorption and anchylosis of the diseased vertebræ.

221. *c.* When the general palsy is of an *acute* character, or is caused by inflammatory congestion, or by any of the more immediate consequences of inflammation of the membranes or substance of the chord, then local depletions near the seat of pain, and the prompt use of mercurials, of blisters, or of the terebinthinate embrocation in the course of the spine, and of the other remedies recommended above (§ 216) for paraplegia, should not be neglected.

222. *d.* When the disease is *chronic*, or has been neglected, or has not yielded to these means, then the bichloride of mercury, the sul-

phate or the valerianate of zinc, the iodide of potassium, the tincture of cantharides, the tincture of capsicum, &c., may severally be employed as already advised (§ 218). Indeed, the treatment of general palsy, in its several forms, is in every respect the same as that advised for paraplegia.

223 iii. Paralysis in Children should be treated according to the principles above developed, and with strict reference to the presumed pathological condition. If the palsy be *partial* or *hemiplegic*, and be inferred to have arisen from injury during parturition, or apparently *acute*, the application of a leech behind the ear (of the unaffected side in the hemiplegic variety), and repeated doses of calomel, should be prescribed. Minute doses of the iodide of potassium may be given subsequently, and the bowels ought to be kept freely open. If the palsy be congenital and independent of injury, the iodide of potassium or the iodide of mercury, or the bichloride of mercury, may be tried in minute doses and with due caution. In the more *chronic* cases of infantile paralysis, these constitute the chief remedies, but they should be continued for a considerable period and gradually increased, a course of the one being alternated with that of the other, as already advised.

224. If the infant be able to take the breast, recovery to some extent may be expected, although it may not be complete. I have at present under my care a patient in a fit of gout, aged between forty and fifty years, who was hemiplegic from earliest infancy, but he is unable to state whether it was congenital or caused by injury during parturition. The limbs of the paralyzed side are considerably smaller than those of the sound side, and their movements weak, difficult, and constrained. The imperfect growth of paralyzed limbs in infancy is owing chiefly to the very imperfect use made of them during the epochs of development.

225. iv. Treatment of Shaking Palsy.—Amendment has not followed any mode of cure which I have tried, and I have tried the most energetic means for this form of palsy, when it appears *gradually* and in a *chronic form*. When, however, the tremour occurs in a more *acute form*, or consecutively of suppressed evacuations, in strong or plethoric patients, as in the case adduced from Frank (§ 99), or when it is attended by pain in the head or in the course of the spine, then antiphlogistic remedies, particularly local depletions, blisters, or the terebinthinate embrocation in the course of the spine, purgatives, mercurials, &c., followed by the iodides, the bichloride of mercury, or the valerianate of zinc, and a seton in the nape of the neck, may be severally employed, according to the peculiarities of the case, or other energetic means about to be noticed may be tried.

226. In all cases of *paralytic tremour*, the existence of an arthritic or rheumatic diathesis should be ascertained, and the treatment modified accordingly. In such instances, tonics, opiates, and antispasmodics, with ammonia or other alkaline substances, may be prescribed. When the disease has probably arisen from masturbation, or excessive sexual indulgence—the most frequent of its causes—then the preparations of iron with the tincture of cantharides, or of capsicum, or with camphor, or with the nitro-hydrochloric acids, or the extract of nux vomica, or opium conjoined with aromatics, may be tried, according to the peculiarities of the case, and to the effect produced; and they may be aided by stimulating embrocations, or plasters applied on the spine, as the *liniments* in the *Appendix* (F. 308, 311), or the emplastrum thuris comp., &c., &c.

227. v. Paralysis caused by Poisons requires a treatment appropriate to the nature of the deleterious agent.—*a*. When the affection is caused by the preparations of *lead*, the state of the digestive organs first requires attention. (*See art.* Colic from Lead.) After the alvine secretions and excretions are more or less improved, and their discharge is rendered more regular and healthy, the preparations of *nux vomica* or *strychnia* may be exhibited, but their effects should be carefully watched. In this disease I have preferred the resinous extract of nux vomica to strychnia, and have generally prescribed it in combination with the purified extract of aloes. In aid of these, the external stimulants, hereafter to be mentioned, suitable exercise of the paralyzed parts as far as they may admit of it, and the application of splints, extending from the elbows to the fingers in cases of palsy of the wrist or arm, should not be overlooked. In addition to friction with various stimulating substances, electricity and galvanism, warm salt-water bathing, and warm baths containing stimulating substances, may be employed. Cleanliness and the removal of the cause always should be enforced. During the treatment the regular discharge of the alvine functions ought to be promoted, and the patient should be allowed a generous diet.

228. *b*. The states of palsy caused by other poisonous substances should be treated conformably with the principles already explained—with strict reference to the states of vascular action and vital power, both general and local. The tremulous form of palsy sometimes caused by *mercury* (*see* Arts and Employments, § 23, *et seq.*) requires similar means to those just recommended for palsy from lead. This observation also applies to the palsy of the extremities sometimes produced by *arsenic*. In all these, internal stimulants, tonics, and restoratives; attention to the digestive and defæcating processes; external excitants, electricity, &c., and nutritious diet, are requisite.

229. Palsy consequent upon *narcotic poisons* should be treated according to the states of vascular action and nervous power. After due recourse to their respective antidotes, &c., local depletions, purgatives, external derivatives, &c., in order to remove congestion of the nervous centres, should be prescribed, and, if the malady still persists, the several alterative, restorative, and stimulating remedies recommended for the *chronic states* of palsy ought to be employed, according to the peculiarities of the case, and the circumstances of the patient.

230. vi. The Treatment of the Complications of Palsy requires but few remarks, as the most important of these complications is duly considered in the articles on the diseases of which palsy is a part, or of which it is consecutive. Under the heads Apoplexy, Inflammation of the Brain, and Insanity, the asso-

ciations of paralysis with these are fully discussed.—*A.* I have already noticed *that palsy may either follow or precede inflammation of the nervous centres*, and have explained how this may arise (§ 125). Hence it is requisite to watch carefully all cases, especially of hemiplegia, where it is inferred that the palsy is caused by extravasation of blood, particularly during the first three or four weeks of the disease; and, upon the first indication of inflammatory irritation, to have recourse to antiphlogistic measures co-ordinately with the indications for their use. The evidence of inflammatory action in the vicinity of the lesion producing paralysis, at whatever period it may appear, as described above (§ 128), is a sufficient reason for the having recourse to local depletion, purgatives, external derivatives, and alteratives, and for relinquishing tonics, stimulants, or excitants of any kind, should those have been resorted to.

231. *B.* The *complication of insanity with general palsy* admits of little or no hope, even of partial benefit. Still, the alteratives already noticed, combined with tonics and restoratives, should be prescribed, particularly the iodide of potassium with sarsa, or with bitter infusions; the extract of nux vomica with aloetic or other aperients; the bichloride of mercury with the compound tincture of cinchona; the valerianate of zinc, and other means already noticed (*see art.* Insanity, § 444–446). In the association of palsy with *puerile imbecility* or *idiocy*, the case is hopeless, for the reasons assigned above (§ 127).

232. *C.* The treatment of *disease of the cranial bones*, or of the *vertebræ, associated with palsy*, may be said to have been already noticed (§ 217), since the same means as have been advised for the more chronic cases of paraplegia, or of general palsy, are also appropriate to this complication. In the more common cases of this kind, namely, in those where the vertebræ are diseased, but little can be done with rational hopes of success beyond what has been recommended above (§ 217, 220). But in the course of treatment, the intercurrence of inflammation of the membranes, or even of the chord itself, should be guarded against and watched for, and be promptly opposed by the means already indicated (§ 216, 221).

233. *D.* The *association of palsy with neuralgia or rheumatism*, or with pains resembling these affections, should always lead to the suspicion of congestion, or inflammatory action, of or near to the origins of the nerves which are the seat of pain, or which supply the pained parts; and when the palsy is, moreover, complicated with *spasms* or *cramps*, the same lesions should be inferred, and a treatment based upon the inference be prescribed.

234. *E.* I have already contended that the *association of palsy with disease of the kidneys and urinary organs* is most frequent and important; and that the latter morbid condition, even when it is apparently the primary one, is generally only the consequence of congestion of the vertebral or spinal sinuses, causing pressure on the chord, or increased effusion into its sheath (§184, *et seq.*). In these cases the urinary functions may be disordered to a most serious extent, or even for a long time, before symptoms of paraplegia are evinced, or the movements of the limbs are materially affected. When the spinal congestion interrupts or otherwise changes the functions of the kidneys, the consecutive excrementitious plethora may occasion either hemiplegia, or coma with general palsy. In some cases the congestion of the spinal veins and sinuses is soon followed by acute congestion, or inflammation of the kidneys, or by suppression or retention of urine, paralytic symptoms not appearing until the renal malady is far advanced. In these circumstances the treatment is obvious. Cupping on the loins, or near the part of the spine chiefly affected, according to the severity of the attack and the habit and constitution of the patient, should always be directed, and afterward terebinthinate embrocations ought to be applied to the loins and spine.

235. *F.* The nature of the occasional connexion of *palsy, especially paraplegia, with hysteria*, has been already noticed (§ 140, 188). The irregularities often observed in the urinary functions of hysterical patients may often be attributed to the irritation propagated from the uterus and ovaria, either directly by the ganglial nerves to the kidneys and bladder, or indirectly to the spinal chord, and thence to the urinary organs along the nerves communicating between them and the chord. In those cases where the protracted irritation of the uterine organs, in connexion with exhaustion of nervous power, disorders not only vascular action in these organs, but extends itself and its effects upon the vascular system, not only to the spinal chord, but also to the urinary organs, pain or aching in the loins, and even tenderness on pressing the spinous processes of the vertebræ, are often observed; and if the vascular disorder consequent upon the local excitement or irritation advances far, so as to occasion certain of its most prominent effects, numbness, cramps, or spasms of the lower extremities; retention or suppression of urine, sometimes alternating with an unusually large secretion or flow of it; occasional nausea, vomiting, and irregularity of the bowels; irregularity, or difficulty, or suppression of the catamenia; and, ultimately, even more or less complete paraplegia may result. Several cases of this kind have occurred to me, and have long resisted treatment until they were submitted to energetic courses of the alterative medicines above advised (217), particularly the bichloride of mercury, or the iodide of potassium, variously combined, aided by terebinthinate enemata and embrocations, by the extract of nux vomica, and by such of the remedies already mentioned as were most appropriate to the peculiarities of the case. In the remarkably severe and prolonged instance noticed above (§ 139), for which all the usual means had been exhausted, in addition to several of the means now noticed, a pea-issue was made in the inside of each thigh, and kept freely discharging until the amendment was complete. The recovery was rapid in this instance, and the lady is now in the enjoyment of good health.

236. *G.* I have met with several instances of *palsy, and especially of hemiplegia, associated with visceral disease.* The connexion between organic disease of the heart and hemiplegia, as that between the former and apoplexy, is sufficiently obvious; and neither it nor the treat-

ment of the complication requires much comment, inasmuch as our remedial measures should be directed primarily to the cardiac lesion, and subsequently or collaterally to the paralytic affection; the states of these lesions, in connexion with the age, habit of body, &c., of the patient, controlling the plan of treatment and the choice of means.

237. *H.* The *complication of palsy with hepatic disease* has been observed by me on several occasions, the palsy being generally hemiplegic, and the right side being that affected in nearly all the cases I have seen. Although in some cases the liver has appeared to have been primarily affected, still it is very probable that the loss of power in the voluntary nerves and muscles of the right side may have in some degree affected the functions and circulation of the liver, and, in prolonged cases, ultimately induced disease of it. In these associations the principles of treatment and the choice of medicines will readily suggest themselves to those who have perused the foregoing remarks, and what I have adduced on the treatment of diseases of the liver.

238. Palsy may, moreover, be associated with *scorbutus*, and it not unfrequently occurs in the *gouty* or *rheumatic diathesis*, more especially after irregular, displaced, or suppressed gout. In these circumstances, the treatment should be varied according to the diathesis. In the gouty association of the malady the usual means should be employed to develop the gout in the lower extremities.

[Paraplegia not unfrequently occurs in this country in the course of continued or remittent fever, perhaps more often in chronic than acute cases, and where repeated relapses have occurred. If not speedily fatal, it is of difficult removal, and generally obstinately protracted. The most successful treatment consists in rest, repeated applications of cups to the spine, and mild purgatives during the periods of the disease, in which there is often considerable febrile excitement, and afterward moxas. The treatment is, therefore, essentially the same as that of inflammatory affections of the medulla spinalis. In the non-inflammatory stages of the disease, strychnine or galvano-magnetism will be found useful. Sufficient attention is far from being paid to those violent pains in the back, indicative of spinal congestion, in the commencement of our congestive, and even our common continued fevers. External revulsives, cups, leeches, and the warm bath may all be brought into requisition with much advantage in a large proportion of these cases.]

239. vii. The Appreciation and Appropriation of Remedies for Palsy.—In discussing the treatment of the several forms of palsy, it has been, as will be seen above, a principal object to advise the use of such means as appear the best calculated to remove the morbid changes upon which these forms severally depend; and mention has been made chiefly of those remedies which seem to me most likely to produce this effect, and of which I have had more or less experience. It is necessary, however, to a full exposition of the treatment of palsy, to review the application of the more energetic means to certain states of the disease and of the constitution, and to notice other medicines which have been favourably mentioned by writers of reputation.

240. After devoting due consideration to the *seat* and *nature of the lesion* of which palsy is the prominent and most manifest phenomenon, it next is of importance to estimate correctly the states of vascular action and of nervous and vital power; to ascertain, as nearly as may be, how far the affection may be considered, from these states, in connexion with its cause and duration, to be *acute* or *chronic*, and *sthenic* or *asthenic*. These terms, it is true, are merely conventional; but they nevertheless assist us materially in our attempts at briefly indicating the conditions of the patient, which powerfully influence the operation, and which should, therefore, guide our choice of medicinal agents for this malady.

241. *a.* Of *blood-letting*, general and local, it may be briefly stated that it is generally required early in attack, especially in acute and asthenic cases, and more particularly in the hemiplegic or sanguineous form of the disease. In the paraplegic and partial states of the malady local blood-letting is commonly to be preferred to general; and in all cases the quantity, as well as manner and repetition of the depletion, should depend upon its effects, the state of the pulse, and habit of body of the patient, as well as upon the predisposing and exciting causes of the attack. We must not, however, inconsiderately prescribe either venesection or cupping in all cases, even of hemiplegia, because we find them to have been advised by Celsus, Zacutus Lusitanus, Home, Abercrombie, and many other eminent writers. The most recent of these writers recommends it too profusely, too generally, and too exclusively, at least as regards the inhabitants of large cities and manufacturing towns, wherein the causes of the malady and the asthenic states of a very large proportion of those attacked either admit not of depletions, or require very different or even opposite means of cure. During the treatment of both hemiplegic and paraplegic palsy, intercurrent inflammatory action may appear, and require, generally, depletions by cupping or leeches; and the physician should be alive to such an occurrence when he has recourse to stimulating medicines, in doubtful circumstances, and in young persons.

242. *b.* Of *evacuants*, *purgatives* and *diuretics* are the most appropriate; and of the former of these, the most active should be selected, and such as influence most energetically the principal secreting viscera, as calomel, colocynth, jalap, scammony, &c. In paraplegia, and even in hemiplegia, the bowels are very torpid, and require repeated and full doses of these, and even of still more energetic cathartics, as croton oil or elaterium, in some obstinate cases. In many, recourse should also be had to purgative enemata, particularly to those in which the oleum terebinthinæ is an ingredient. It is not merely necessary regularly to evacuate fæcal matters by means of these, but to employ them so as to derive from the cerebro-spinal axis any increased flow of blood to it which may have occasioned or prolonged the attack. Indeed, with these conjoined objects, they are advised by Hallè, Dalberg, Brodie, and others who have insisted on their use.

243. The ancients advised a recourse to *diu-*

retics in palsy, and some of the medicines prescribed by modern physicians, and considered by them to influence the disease merely as stimulants, owe no small share of their good effects to their operation on the kidneys. Of these, the most efficient are the tinctura lyttæ, the preparations of iodine, and spirits of turpentine—substances of which farther notice will be taken hereafter—which require caution in their use, and which are suited chiefly to chronic and asthenic cases, and to the paraplegic states.

214. *c.* Of *alteratives*, the most beneficial and most generally appropriate are *mercurials*, *iodine*, and the *iodides* and *sarsaparilla*.—*a. Mercurials*, employed so as to affect the system, and chiefly by inunction, have been recommended for palsy by Schenck, Schneider, Cavallini, and J. P. Frank; and, both internally and externally, by Vallisneri, Burger, and many others. I have seen them of service, when judiciously prescribed, in both hemiplegic and paraplegic palsy. J. P. Frank prescribed them more especially for saturnine palsy, in which he has seen them of great service. In acute and sthenic cases, calomel given with antimony, after blood-letting, until the pulse is sufficiently reduced, should be preferred; afterward, the milder mercurials may be substituted; and, in chronic and asthenic cases, the bichloride may be given in the decoction of bark until the gums are slightly affected, especially in scrofulous and rheumatic constitutions. I lately attended a patient in hemiplegia (Mr. G., of Watling-street), for whom I prescribed the bichloride of mercury, in this combination, a frequent recourse to purgatives, and a seton in the nape of the neck, with the best results. His right side was affected, and he now can walk unaided, and writes letters and checks as usual.

245. (*b*) I have prescribed *iodine* and the *iodides* in several cases of the various forms of both partial and general palsy; but in no case of the disease have I ventured to employ them otherwise than in very small doses at first, carefully watching their effects, and cautiously increasing the doses. Dr. Manson was the first who published cases of palsy in which iodine had been employed; and these cases show not only the good effects of this substance in certain states of palsy, but also its injurious influence in the more acute and sthenic cases, and when prescribed in too large doses. Dr. Manson employed only the tincture of iodine; but, both before and after the publication of his cases, I had used both this and the iodide of potassium for this disease, as well as for some others, in public and private practice; and more recently the iodides—the iodide of potassium and the iodides of mercury—more frequently than the pure iodine. These preparations, especially the last, are best suited to the more chronic and asthenic cases, or after depletions and other evacuants have been pushed sufficiently far. Even then the doses should at first be small, and the effects upon the pulse be carefully watched. The occurrence of headache ought to cause an interruption in the use of these medicines. The iodide of potassium may be conjoined with liquor potassæ and sarsaparilla, commencing only with one or two grains, and gradually increasing it. I have even given only one grain in the twenty-four hours with advantage.

246. *d. Stimulants* and *tonics* were employed internally for palsy much more frequently by the older writers than by physicians of the present day, who are more conversant than they generally were with the true seat and nature of the lesion causing the paralytic attack. These substances are contra-indicated in all acute and sthenic cases of palsy, and whenever there is reason to infer the existence of inflammatory irritation, hæmorrhage, or vascular extravasation, or even of active congestion, while they may be employed with reasonable hopes of benefit in chronic and asthenic cases, and when the disease has appeared after exposure to cold or to other depressing influences, or has followed exhausting causes.

247. (*a*) Of this class of medicines the resinous *extract of nux vomica* and *strychnine* have been more frequently employed than any other in recent times. Of the two preparations, my experience induces me to prefer the former as more manageable than the latter, and equally efficacious. I have usually prescribed it in conjunction with purgative or aperient extracts. It, as well as other internal stimulants, should never be given in palsy, especially hemiplegia, when the pulsation of the carotids or the temperature of the scalp is at all increased; and if the pulse become strong or frequent, or the face flushed during its use, it should be discontinued, and local depletions, with an antiphlogistic treatment and regimen, instantly adopted. It is most serviceable in paraplegia and in lead palsy.

248. (*b*) The flower of the *Arnica montana* was much praised, and is still much used in Germany and Denmark for paralytic cases. It has received the commendations of Angeli, De Meza, Conradi, Aaskow, and others; but I am not aware of any other British physician besides Home who has given it a trial, and his evidence is not much in its favour. The *Rhus radicans*, or *Toxicodendron*, has been recommended in this disease by Brera, Desgranges, Van Mons, Kok, and Alderson; but Zadig considers it quite inefficacious. A decoction of the *Chenopodium ambrosioides* has been advised by Rudolphi, Baldinger, and Lentin; *serpentaria* and *capsicum* by Falconer; *guaiacum* by Fothergill and Johnston; *ammoniacum* by Bourget; *pyrethrum*, internally, by Oxley; *cajeput oil*, both internally and externally, by Pereboom and Thunberg; *naphtha* by Ramazzini; *camphor* dissolved in turpentine by Schumacher; this substance dissolved in naphtha by Reichsanzeiger; *musk* by Truener, Lœffler, and others; *castor* by Pauli; the tinctura *lyttæ*, internally, by Vaughan, May, Brisbane, &c.; *phosphorus* dissolved in ether, internally and externally, by Brera and Gaultier-Claubry; and the *nitrous oxyde gas* by Beddoes, Hill, and Pinel. It is very probable that these may severally prove of service when judiciously prescribed, especially in those circumstances of the disease to which I have above (§ 246) limited the use of stimulants and tonics. In the same category *aconite* may also be noticed, it having been recommended by Stœrck and Greding; also, *opium* and *belladonna*, which have severally been used by Stoll, Thomann, and others, in palsy from lead. [The *ergot*, or *secale cornutum*, has

been found very useful in the treatment of paraplegia. It is believed to stimulate the lower portion of the spinal chord, to which, perhaps, its influence over the bladder and uterus is owing. It may be given in daily doses of from fifteen to sixty grains.]

249. The circumstances which admit of the internal use of stimuli also allow a recourse to *electromotive agencies* in the several forms in which they have been employed; and in no disease have they been more generally and more empirically resorted to than in this. *Electricity*, in the form of shock, bath, sparks, &c., although chiefly prescribed by persons ignorant of medicine, has received the cautious sanction of Vander Belen, Hart, and others, in the most chronic and asthenic cases. Meyer, Bang, and Percival advise it chiefly for paraplegia and lead palsy; and they, with Stoll, De Haen, Quarin, and Falconer, doubt its efficacy in other circumstances. The *electro-galvanic* influence was first recommended by Volta in this disease; and it was soon afterward adopted by Walther, Hallè, Marcus, and Grapengeisser for those cases in which powerful stimulants seemed to be required. [We have derived signal benefit in many cases of local palsy from the employment of electro, or *galvano-magnetism*, applied to the paralyzed muscles in currents of moderate intensity, and gradually increased in force. Although many cases will not be materially benefited by it, there are others which will at once yield to the repeated and judicious application of this remedy.]

250. *e.* The numerous means which may be strictly called *external*, and which have been so generally resorted to in this disease, operate either (1) by rousing the circulation and exciting the nervous influence in the part, as simple or medicated friction; (2) or by deriving irritation or other morbid action from the nervous centres to superficial parts, as issues, setons, &c.; (3) or by a combination of these modes of operation, as blisters, sinapisms, urtication, &c. These means are severally appropriate to most of the forms of palsy; and, when judiciously selected, they may be safely used in the various states and relations of the disease.

251. (*a*) *Frictions* in a simple form, although advised by Stoll and Hilscher, are seldom employed; for some medicinal substance with which frictions may be used is requisite to impart confidence to the patients in their efficacy. However, they may be advantageously employed by means of the hair-glove, or of the kheesha, or Indian glove. Frictions of the palsied limbs with various stimulating substances, as with phosphorus dissolved in oil or ether; with camphor, soap, and turpentine; with cajeput oil, camphor, olive oil, &c., have been often advised, and may in a few instances prove of service.

[Dr. Graves recommends very highly a liniment of strong acetic acid, ʒss.; spirit of turpentine, ʒiij.; rose water, ʒijss.; essential oil of lemons, x drops; and a yolk of egg in sufficient quantity to suspend the turpentine. This is to be applied by means of a sponge; after a few applications, it produces an eruption of small pimples, and proves very efficacious.]

252. (*b*) *Issues and setons* are, upon the whole, the most efficacious modes of permanent external derivation in palsy, and the most generally adopted, especially in this country. The former may be made in the scalp itself, by incisions in or near the occiput, pease being afterward inserted; the latter may be worn in the nape of the neck. They have been praised by Pott, Appleton, Latour, Schreger, Prichard, and Loder; and I have had several occasions of witnessing their good effects. *Moxas*, which have been for ages employed in the East as the usual mode of external derivation, have been strongly insisted upon by Larrey and others in this and other diseases, and have been much employed on the Continent of Europe; but their superior efficacy to issues or setons is very doubtful. [*Moxa* is a remedy by no means to be neglected in paralysis. We have known cases of general paralysis where moxa, applied on each side of the spine, near the second dorsal vertebra, procured immediate benefit.] The *actual cautery*, mentioned by Paulus Ægineta, and others of the ancients, has been recommended, also, by Richter, Portal, and J. P. Frank. Neri Nerii, a Neapolitan physician of the sixteenth century, directed it to be applied to the occiput in hemiplegia. Among the usual means of derivation, *dry-cupping*, mentioned by Celsus and others in this disease, should not be overlooked.

253. (*c*) *Blisters*, kept discharging for a considerable period, or frequently repeated, as advised by Boerhaave, Fordyce, and Dickson; or *artificial eruptions*, produced for a longer or shorter period, by means of tartarized antimonial ointment, or by croton oil, are also frequently of service both in acute and chronic cases; but in the former especially, after local depletions and evacuations have been freely practised. The same remark is applicable to the use of *sinapisms*, and to a frequent recourse to *urtication*, which has been advised by Paulus Ægineta, Muys, Home, Hufeland, and many others. or to *embrocations* containing capsicum, or its tincture, or pyrethrum, all which exert the double effect noticed above (§ 250), when applied to the paralyzed limb, as they should generally be applied, unless in cases where the sensibility and temperature of the paralyzed limb are morbidly increased, as sometimes observed; and then they may even prove injurious, especially in asthenic cases. In these, also, blisters applied to the palsied limb may be followed by sloughing.

254. *f. Simple*, and *medicated*, and *mineral warm baths* have been much praised in palsy; but it is obvious, from the nature and forms of the disease, that, although they may be of service in some instances, they may be injurious if inappropriately or indiscriminately employed. I have seen them of service in chronic and asthenic cases, and in those states of the disease caused by exposure to cold. Medicated warm baths—with warm and aromatic substances—were most beneficial in a case of general palsy arising from this cause that came under my care. J. P. Frank notices favourably simple and sulphureous warm baths, and states that those of Baden have been of service in some obstinate cases of chronic palsy. In recent, acute, or sthenic cases, he justly dreads the use of warm baths, whether simple, mineral, or medicated, as he has known apoplexy supervene where they have been injudiciously prescribed. The sulphureous thermal baths of

Baden were recommended by Stoll, chiefly in lead palsy, after electricity had been employed. It may be noticed, farther, that the warm mineral springs of Bath, Toeplitz, &c., have been frequently resorted to by paralytic patients, and sometimes with more or less advantage, when neither general nor local plethora or congestion exists, or when opposite states of the vascular system obtain; that sulphureous warm baths have been favourably noticed by Baker, Summers, Tolberg, Waitz, and Hufeland; that aromatic and spiced warm baths were recommended by Riedlin; warm salt-water baths by Reil; and even warm chalybeate-water baths by Graefe, in this malady.

255. *g.* The *diet and regimen* in palsy should depend entirely upon the peculiarities of the case. In most cases of hemiplegia, in all acute and sthenic cases, or whenever general or local plethora is inferred to be present, both the diet and regimen should be strictly antiphlogistic; a farinaceous and vegetable diet, with simple diluents only, being adopted. In chronic, asthenic, and anæmic cases, light, digestible animal food may be allowed; but in every instance the predisposing and exciting causes should be viewed in connexion with the pathological conditions, and all these should be duly estimated before either the *treatment*, or the *dict*, or the *regimen* is assigned. The chief part of the regimen in all cases is the careful avoidance of the *causes* (§ 157, *et seq.*) of the disease.

[The treatment of palsy in this country, as in every other, has been very generally empirical, owing to the extreme difficulty of ascertaining in all cases its true pathology. Prof. Geddings, of Maryland, has reported several highly interesting cases which yielded to the influence of *strychnine*. The late Dr. Barton employed internally, with much success, in the Pennsylvania Hospital, *mustard seed* and *horse radish*. Dr. Delafield, of New-York, has recorded several very interesting cases of partial paralysis of the face, in which cupping, leeching, and blistering over the region of the portio dura, mercurial purgatives, and a seton in the neck were instrumental in effecting a radical cure.—(*N. Y. Med. and Phys. Journ.*, Dec., 1824.) We succeeded in curing a chronic case of hemiplegia of several years' standing, in an old lady of 60 years of age, by an alterative course of mercury, which produced very copious salivation.

There is a form of paraplegia, not particularly noticed by our author, owing to ramollissement of the spinal marrow, from retrocession of gout, which, so far as we have seen, is generally incurable. The symptoms come on very insidiously, and it is often not until irremediable disorganization has occurred that the true pathology becomes clearly established. We have derived most benefit in these cases from an open issue on each side of the spine, with occasional aloetic and mercurial purges, with alterative doses of the iodide of mercury. Where local paralysis has occurred from pressure on the nerves of the part, as in the arm, from sleeping upon it, or carrying a weight upon it for a considerable distance, of which we have seen several cases, we have derived most benefit from moxas, or stimulating embrocations to the limb, with an occasional cathartic and regulated diet. In the paraplegia supervening on visceral disease, we have found local remedies, as frictions, blisters, &c., to the legs and thighs, more beneficial than applications over the spine itself. Great benefit will often result, both in hemiplegia and paraplegia, from the free internal and external use of sulphur, especially in the form of the natural sulphur waters of our country, as those of Avon, Richfield, and of Western Virginia. Cases of paraplegia, following the remittent gastric fever of children, are often unconnected with spinal disease, especially in those of a scrofulous temperament, and as a general rule, they are very obstinate under the most judicious treatment. In that form of paraplegia connected with disease of the kidneys, our attention should be partly directed to the first link in the chain of morbid action, or we shall be disappointed in the results of our remedial measures. Dr. Eberle reports two cases of hemiplegia in which he employed, with unequivocal benefit, the saturated tincture of the *Rhus toxicodendron* (*Prac. of Physic*, vol. ii.). Doctor Calhoun, of Philadelphia, has proposed the use of the tourniquet for restoring the power of muscles debilitated by long-continued inactivity (*Philad. Journ. of the Med. and Phys. Sci.*, vol. i., p. 131). Dr. Detmold, of New-York, has recommended a peculiar apparatus of his own contrivance for a paralysis of the lower extremity commonly called "weak ankle," together with the external application of a spirituous preparation of strychnine (*N. Y. Journal of Medicine*, vol. iv., p. 305). Dr. Zabriskie, of Queen's county, has published a well-written essay on paralysis from visceral disorders (*Am. Journ. of Med. Science*, vol. ii., N. S., p. 360), in which he recommends general and local bleeding to subdue the phlogosis, followed by mercurials, when these symptoms abate, and counter-irritation, to divert the inflammation. After the inflammatory symptoms have somewhat subsided, he enjoins the use of strychnine, which he thinks is most useful in that form of the disease which is symptomatic of visceral irritation. Doctor B. F. Joslin, of New-York, has given a history of two cases of paralysis of the face (*American Journ. of Med. Science*, vol. iv., N. S., p. 322), cured by the local application of strychnine (ʒ grs. to ʒj. alcohol) to the part three times a day. In the treatment of palsy we are always to be governed by a due regard to its causes, its pathology, and those various circumstances which modify therapeutical indications. In applying galvanism or electricity to the treatment of paralysis, "It is necessary," says M. Matteucci, "to bear in mind two electro-physiological facts. The first is, that an electric current, if transmitted through a nerve for a certain period of time, destroys the sensibility of the nerve, or, in other words, paralyzes it. If allowed to remain in repose, the nerve, after a certain interval, recovers its excitability." It has been discovered, however, by Matteucci, that the excitability may be restored in a much shorter period by passing a second current through the nerve in an opposite direction. The second fact to be borne in mind is, that if the nerves of a living animal be submitted to the passage of the electric current, renewed at short intervals, tetanic contractions are excited; and if the experiment

be continued for some time, the nerves entirely lose their excitability.

"These are the facts," says Matteucci, "which, independently of all theory or hypothesis, should guide us in therapeutical application of the electrical current to palsies. We may, in fact, admit, that in some cases of paralysis the nerves of the affected limb are in a condition similar to that produced by the continued passage of an electric current. We have seen that, to restore the excitability to a nerve which had been deprived of it by an electric current, it is requisite to conduct the current in the opposite direction. Hence, to cure the paralysis, the current should be passed in a contrary direction to that which has produced it. In a paralysis of motion the inverse current should be employed; while, on the contrary, in a paralysis of sensation, the direct current should be used. In a case of complete paralysis, that is, of both motion and sensation, there is no reason to induce us to prefer the one current to the other.

"Theory also teaches us a rule in its application, never to continue the passage of the current too long, lest we augment the disease we wish to cure. The more intense the current, the shorter should be its duration; and as we have seen that the passage of the electric current in the nerves, repeated at short intervals of time, considerably enfeebles their sensibility when continued for a long time, we must take care and not pass from one extreme to another. Theory advises us to apply the electric current of an intensity which should vary with the degree of the malady, and continue its passage for two or three minutes, at intervals of some seconds. After these two or three minutes, during which we shall have communicated from twenty to thirty shocks, we should leave the patient at rest for some time, and then renew the treatment."—(*Med. Chirurg. Review*, April, 1845.) The same principles, doubtless, should regulate the application of galvano-magnetism, as of ordinary electricity.]

Bibliog. and Refer.—*Celsus*, L. iii., c. 27.—*Pliny*, L. xxviii., c. 16.—*Paulus Ægineta*, L. iii., c. 18.—*Oribasius*, Synopsis, l. viii., c. 14.—*Avicenna*, Canon., l. iii., fen. ii., tract. i., c. 2.—*Zacutus Lusitanus*, Med. Pract. Hist., l. i., No. 45; et vii., obs. 13, 14, 15.—*Morgagni*, De Sed. et Caus. Morb., Ep. ii., art. 11, 14; Ep. iii., *passim*.—*J. Summers*, A short Account of the Success of Warm Bathing in Paralytic Disorders, 8vo. London, 1751.—*B. Franklin*, On Electricity in Paralytic Cases, Phil. Trans. Lond., 1757.—*G. Cavallini*, Storia d'una Paralisia curata con l'Unzione Mercuriale, 4to. Venez., 1769.—*R. Charlton*, An Inquiry into the Efficacy of Warm Bathing in Palsies, 8vo. Oxf., 1770.—*J. N. Marquet*, Traité de Apop. Paral., &c., 12mo. Paris, 1770.—*R. Charleton*, Three Tracts on Bath Waters; 2d. On Palsies, 8vo. London, 1775.—*Haller's* Disput. ad Morbos, &c., vol. i., p. 17, 97, 115.—*Pereboom*, in *Schlegel*, Thes. Patholog. Therap., vol. i., p. 243.—*B. Chandler*, An Inquiry into the Theories and Methods of Cure of Apoplexies and Palsies, 8vo. Cantar., 1784.—*Hart*, in Philos. Trans., vol. xlviii., p. 786.—*P. Pott*, Remarks on Palsy of the Lower Limbs found to accompany Curvature of the Spine, &c., 8vo. Lond., 1779; and Farther Remarks on the same, 8vo. Lond., 1782.—*J. Jebb*, Select Cases of the Disorders commonly called Paralysis of the Lower Extremities, 8vo. London, 1782.—*C. Cramer*, De Paralysi et Setaceorum adversus eam eximio usu; in *Sandifort*, Thesaur. Dissertat., vol. i., p. 127.—Narrative of the Efficacy of Bath Waters in various Paralytic Disorders, 8vo. Lond., 1787.—*J. Alderson*, An Essay on Rhus Toxicodendron, shewing its Efficacy in Paralysis, &c., 8vo. Hull, 1793.—*Vaughan*, in Mem. of the Medical Society of London, vol. i., art. 28, 8vo. Lond.—*Falconer*, in Ibid., vol. ii., art. 20.—*Fothergill*, in Med Observat. and Inquiries, vol. v., p. 394.—*T. Kirkland*, A Comment. on Apoplectic and Paralytic Affections, &c., 8vo. Lond., 1792.—*Rahn*, in Museum der Heilkunde, b. iv., p. 397.—*L. V. Brera*, Riflessioni sul' Uso del Fosforo nell' Emiplegia, 8vo. Pavia, 1798.—*Louyer Villermay*, in Mém. de la Société Méd. d'Emulation, t. v., p. 440.—*Latour*, in Ibid., t. vi., p. 57; Mémoire sur la Paralysie des Extrémités Inférieures, &c., 8vo. Paris, 1805.—*Portal*, Cours d'Anat. Méd., t. i., p. 303; t. iv., p. 118.—*Reil*, Memorab. Clin., fasc. iv., No. 4.—*J. P. Frank*, De Cur. Hom. Morbis, l. ii., p. 46; et l. v., 2, p. 497; l. vi., 1, p. 260; et Interp. Clinicæ, vol. i., p. 145.—*Pinel*, Nosograph. Philosoph., t. ii., p. 93.—*Marcus*, Magazin für Therapie und Klinik, b. i., p. 325.—*F. Frank*, Nuovo Giornale di Milano, t. iv.—*Gaultier de Claubry*, in Journ. Gén. de Méd., t. xvi., p. 18.—*Hufeland*, Journ. der Pr. Heilk., p. 78, 1811.—*M. Baillie*, Med. Trans. of Roy. Coll. of Phys. Lond., vol. vi.—*R. Powell*, Observat. on some Cases of Paralytic Affection, 8vo. London, 1814.—*T. Copeland*, Observat. on the Symp. and Treat. of the diseased Spine, &c., with Remarks on the consequent Palsy, 8vo. Lond., 1815.—*Mollie*, Recueil d'Observat. sur l'Apop. et la Paral. guéris sans retour, &c., 8vo. Paris, 1816.—*J. Parkinson*, An Essay on the Shaking Palsy, 8vo. Lond., 1817.—*J. Copland*, in Lond. Med. Repos., vol. xvii., p. 379; vol. xviii., p. 523.—*Merat*, Dict. des Sciences Méd., t. xx., art. *Hemiplégie*.—*Chamberet*, in Ibid., t. xxiv., art. *Paralysie* et *Paraplégie*.—*J. Cooke*, A Treatise on Nervous Diseases, vol. ii.; on Palsy, 8vo. Lond., 1823.—*D. A. G. Richter*, Die Specielle Therapie, &c., b. viii., p. 821.—*Rostan*, Recherches sur Ramollissement du Cerveau, &c., 8vo. Paris, 1823, *passim*.—*Rochoux*, Dict. de Méd., t. xv., art. *Paralysie*.—*Burder*, in Lond Med. and Physical Journ. for June, 1827.—*Hufeland*, in Journ. des Progrès des Sciên. Médicales, t. iii., p. 254.—*Leuret*, in Ibid., t. xi., p. 167.—*Dugès*, Archives Gèner. de Méd., t. xx., p. 258.—*Cazauvieilh*, in Ibid., t. xiv., p. 5.—*Pelletier*, in Ibid., t. xviii., p. 200.—*Bayle*, in Revue Méd., t. i., p. 33; t. ii., p. 143, 1825; et t. ii., p. 247, 1826.—*Calmeil*, de la Paralysie chez les Aliénés, 8vo. Paris, 1826.—*Taliaferro*, Am. Jour. of Med. Sci., vol. vi., p. 99; et Ibid., p. 227; et t. viii., p. 236.—*Albers*, in *Johnson's* Med. and Chirurg. Rev., No. 43, p. 227.—*S. D. Broughton*, Cases Illust. of the Distinct Functions of the Nerves, in Lond. Med. and Phys. Journ., vol. lvii., p. 413; Trans. of Prov. Med. Association, vol. ii., p. 300; and Lancet, Oct. 1, 1836, p. 34.—*L. F. Calmeil*, De la Paralysie, considérée chez les Aliénés, 8vo. Paris, 1826.—*J. Abercrombie*, Pathological and Practical Researches on Dis. of the Brain and Spinal Chord, 3d edit. Edinb., 1834.—*T. Chevalier*, in Trans. of Med. and Chirurg. Soc., vol. iii., p. 102.—*Shaw*, in Ibid., vol. xii., p. 105.—*H. Earle*, in Ibid., vol. xiii, p. 516.—*E. Stanley*, in Ibid., vol. xviii., p. 260.—*Seymour*, Medical Gazette, Oct. 29, 1836, p. 151; and Dec. 24, 1836, p. 445.—*R. Graves*, in Ibid., May 20, 1837, p. 257.—*Chandler*, Dublin Journ. of Med., March, 1837, p. 164.—*Craigie*, Edin. Med. and Surg. Journ., Oct., 1836, p. 318.—*Todd*, in Cycl. of Practical Med., vol. iii., p. 240.—*B. C. Brodie*, On Injuries of the Spinal Chord; in Trans. of Med. and Chirurg. Soc. of London, vol. xx., p. 118.—*W. Budd*, in Ibid., vol. xxii., p. 153.—*M. Hall*, in Ibid., vol. xxii., p. 191; et vol. xxiii., p. 121-182; and vol. xxiv., p. 83.—*E. Stanley*, in Ibid., vol. xxiii., p. 80.—*C. Hawkins*, in Ibid., vol. xxiv., p. 51.—*J. Webster*, in Ibid., vol. xxvi., p. 1.—*J. R. Bennett*, in Lib. of Pract. Med., vol. ii., p. 274.

Paralysis from Poisons.—*Borellus*, Cent. iv., obs 32.—*Hoffmann*, De Nerv. Resolut., opp. iii., p. 203.—*De Haen*, Ratio Medendi, vol. iii., p. 113.—*Bang*, in Acta Reg. Soc. Med. Hamn., vol. i., p. 102.—*Stoll*, Rat. Medendi, part ii., p. 416.—*Falconer*, Mem. of Med. Society of Lond., vol. ii., p. 224.—*Brandis*, Ueber die Wirkung der Eisenmittel, &c., p. 150.—*Percival*, Essays, vol. ii., p. 290.—*Murray*, in Edin. Med. and Surg. Journal, vol. xviii., p. 167.—*Bateman*, in Ibid., vol. viii., p. 376; and vol. ix., p. 180.—*Berat*, Beiträge zur gerichtlichen Arzneikunde, b. iv., p. 221.—*Burger*, in *Horn's* N. Archiv., b. ii., p. 340.—*Merat*, Traité de la Colique Metallique, p. 275.—*R. Bright*, Reports of Medical Cases, &c., 4to, vol. ii., p. 495.—*R. Christison*, A Treatise on Poisons, &c., 3d edit., 8vo, p. 290, 386, 515. Edin., 1836.

Paralysis of Infants and Children.—*Cazauvieilh*, in Archives Génér. de Médicine, t. xiv., p. 5, 349.—*E. Kennedy*, in Dublin Medical Journ., vol. x., p. 430.—*R. Doherty*, in Ibid., vol. xxv., p. 82—*H. Kennedy*, Dublin Medical Press, Sept. 29, 1841.—*M'Cormac*, in Lancet, May 27, 1843.—*C. West*, in Med. Gazette, vol. xxxii., p. 829.—*Colmer*, in Ibid., April 21, 1843. (See, also, the Bibliog. and Refer. to arts. Apoplexy, Brain, *Structural Lesions of*, and Spinal Chord.)

[Ad. Bibliog. and Refer.—*Wm. T. Taliafero*, Paralysis successfully Treated with Moxas, in Am. Jour. Med. Sci., vol. vi., p. 99.—*J. H. Miller*, in Am. Jour. Med. Sci., vol. xiv., p. 321, On Galvanism in Paralysis.—*W. E. Horner*, A Treatise on Pathological Anatomy.—*J. R. Lucas*, in Am. Med. Recorder, 1826, p. 239.—Boston Med. and Surg. Jour., vol. xxviii., p. 362.—*S. B. Tobey*, in Bost. Med. and Surg. Jour., vol. xxvii., p. 415 (Case of partial paralysis of the face in a child cured by galvanism, applied by moans of "Page's Revolving Armature for Shocks").—*W. J. Barber*, in Bost. Med. and Surg. Journ., vol. xviii., p. 263.—*B. Strobel*, in South. Med. and Surg. Jour., 1836.—*H. Chand-*

ler, in Bost. Med. and Surg. Jour., vol. xv., p. 91.—*S. H. Dickson*, Essays on Pathology, Therapeutics, &c., 2 vols. Charleston, 8vo, 1845.—*R. Dunglison*, The Practice of Medicine, 2 vols., 8vo. Philad., 1844.—*W. P. Dewees*, A Practice of Physic, &c., 8vo. Philad., 1853.—*H. A. Potter*, in New-York Journ. Med. and Collat. Sci., vol. iv., p. 174.—*W. P. Buel*, in New-York Journal Med. and Collat. Sci., vol. ii., p. 34.—*R. J. Graves*, Clinical Lectures, with Notes, by *W. W. Gerhard*. Phil., 1842, 8vo.—*John Eberle*, A Treatise on the Practice of Medicine, 2 vols., 8vo. Phil., 1835.—*J. Bell* and *W. Stokes*, Lectures on the Theory and Practice of Physic, 3d ed., 2 vols. Philad., 1845, 8vo.—*Samuel Annan*, in Am. Jour. Med. Sci., vol. ii., N. S., p. 99.—*J. B. Zabriskie*, in Am. Jour. Med. Sci., vol. ii., N. S., p. 360.—*Detmold*, in New-York Journ. of Med., vol. iv., p. 305.—*S. Calhoun*, in Phil. Jour. of the Med. and Phys. Sci., vol. i., p. 131.—*Edword Delafield*, in New-York Med. and Phys. Jour., Dec., 1824.—*B. F. Joslin*, in Am. Journ. Med. Sci., vol. iv., N. S., p. 322.—*Alban Goldsmith*, Case of paralysis from fracture, in which the spinous processes of two vertebræ, half of the third and the whole of the fourth, were removed by an operation, with partial success, in Am. Med. and Surg. Journ., 1829.]

PAROTID GLAND—Diseases of.—This gland is often the seat of inflammation, of congestion, of scrofulous enlargement and inflammation, and of several other structural lesions. It is liable to be variously affected by the ingesta, whether alimentary or medicinal; and it is often the seat of symptomatic disease, particularly in the course of those maladies which reduce vital power or contaminate the blood. The diseases of the parotid may be divided into, 1st. The *functional*; 2d. The *inflammatory*; and 3d. The *structural*.

I. Functional Disorders of the Parotid Gland.

Classif.—I. Class, I. Order (*Author*).

1. These disorders have received but little attention from medical writers; for, unless in a few prominent cases, they seldom attract attention, and even in these they are generally *symptomatic* of some more important malady to which a primary and principal attention should be paid. The functional disorders of the parotid consist chiefly of *excessive* and *diminished* secretion. Doubtless, an alteration of the *quality* as well as of the *quantity* of the secretion often obtains, but the latter change is more obvious, while the former can be inferred chiefly from the deposites formed from the salivary fluid, either in the ducts or upon the teeth; or from the action of chemical re-agents, which, according to M. Donnè, evince more or less of acidity in inflammatory diseases, with an increase of the animal elements. (*See art.* Saliva.)

2. i. Deficient Secretion of the Parotids arises from numerous circumstances and agents affecting the digestive organs or the constitutional powers. Great mental anxiety; heating articles of food, condiments, and beverages; general vascular excitement; and morbid states of the blood, may diminish or altogether arrest the action of the parotids and other salivary glands. Irritation or inflammation of the stomach, or of other digestive organs, sometimes has a similar effect; and numerous stimulating, astringent, and anodyne medicines impair the action of these glands, although in a very uncertain and capricious manner. Deficiency of the salivary secretion also generally attends most fevers and inflammatory diseases, more especially those fevers in which the blood is early contaminated; and in the more malignant maladies, when the action of the parotids is arrested, the glands themselves become swollen and tender. The secretion of these glands is generally diminished in diabetes and diseases of the kidneys. (*See arts.* Saliva *and* Salivation.

3. ii. Increased Action of the Parotids often arises from the ingestion of various articles of food, condiments, and medicines; but when it is caused by food or condiments, it is generally transient and slight. It is often very remarkable and prolonged when caused by medicine, especially by mercurials; and it is usually more moderate and irregular when it is symptomatic of other diseases, as of affections of the pancreas, or of the stomach or duodenum, &c. Seeing, however, that the functions of the parotid are generally affected co-ordinately with those of the other salivary glands, whether quantitatively or qualitatively, they will be more particularly considered in relation to diagnosis and prognosis, under the heads Saliva and Salivation.

II. Inflammation of the Parotid Glands.

Synon.—Παρωτις (from παρα, near, and ους the ear), Galen. *Parotis*, Vogel, Sauvages, Pinel. *Parotitis*, Darwin. *Cynanche Parotidæa*, Cullen, Parr. *Angina externa*, Russel. *Empresma parotitis*, Good. *Cauma parotitis*, Young. *Oreillons*, *Parotide*, *Ourles*, Fr. *Entzündung der Ohrdrüse*, Germ. *Parotite*, Ital. *Mumps*, *Branks*, *Inflammation of the Parotid.*

Classif.—1*st Class*, 2*d Order* (*Cullen*). 3*d Class*, 2*d Order* (*Good*). III. Class, I. Order (*Author*).

Defin.—*Pain, tenderness, and swelling in the situation of one or both parotids, with symptomatic fever, occurring either sporadically, endemically, or epidemically.*

5. i. Causes and History.—*A.* Parotitis is most frequently observed in children, and about the period of puberty, and but rarely after twenty-five or thirty years of age, in an *acute form*, although it sometimes occurs in advanced life as a chronic disease. M. Begin thinks that it is more frequent in children of the male than of the female sex. It proceeds, *sporadically*, from cold conjoined with humidity, and from currents of cold air. It is sometimes so prevalent in cold and humid localities, especially during the colder months, as to be *endemic*; and it is occasionally *epidemic* in extensive districts. When thus prevalent, it has appeared in many instances to have been propagated by *infection*, particularly in schools and in ships, &c., where a single case has frequently been followed by very many; but in these circumstances the propagation of the complaint may be imputed to exposure to the same physical agents and atmospherical states; although the removal of a boy from a school in which the disease prevailed to a locality where it was unknown, and the subsequent infection of other children by the one removed, militate against these agents having been the cause, and evince an infectious property. I have seen two instances of the disease appearing in nurses while attending on persons affected with erysipelas of the face and scalp, and in both these the adjacent cellular tissue was much implicated. One or both glands may be affected; and when the disease is epidemic, the maxillary glands are often similarly diseased. The accumulation of morbid secretions or of fæcal matters in the *prima via* evidently favours or predisposes to an attack of the complaint. Ep-

idemic parotitis very rarely attacks the same individual a second time. In scrofulous persons, simple or sporadic parotitis often assumes a modified character, and becomes chronic or prolonged. It not infrequently follows scarlet fever and other exanthematous fevers, and then assumes a very severe and troublesome form, particularly after scarlatina, the inflammation often extending far into the adjoining cellular tissue and to the lymphatic glands of the neck

6. *B. Symptoms.—a.* The *invasion* of the complaint is usually indicated by irregular chills or rigours, followed by lassitude; pain and tenderness, with stiffness in the neck; frequency of pulse; heat of skin; difficulty of mastication, owing to swelling and pain in the situation of one or both parotids; occasionally a somewhat increased flow of saliva; slight difficulty of deglutition, more or less increased when the adjoining glands are affected, and by the usual attendants on symptomatic fever, as thirst, loss of appetite, costiveness, headache, &c.

7. In some cases the symptoms are even milder than now stated. The swelling, pain, tenderness, and tension are slight; the pulse is but little affected; and the organic functions are not materially disturbed. From this state of extreme mildness every grade of severity occurs, until the disease assumes much more intense characters, both locally and generally. In these latter the swelling is great, not merely in the situation of one or both parotids, but extends to the sub-maxillary glands, sometimes also to the tonsils, and to the adjoining cellular tissue. In these cases there are generally much heat and sensibility of the parts, often with more or less redness, and always with difficult mastication and deglutition, owing to the great tumefaction. There are also acute symptomatic fever, with urgent thirst, loss of appetite, severe headache, flushed countenance, &c.

8. *b.* The *duration* of the complaint varies much in the *simple* and *sporadic form* of the disease; beginning to subside in four or five days in some cases, and continuing to increase during a longer period, or passing into suppuration in others. When it follows the eruptive fevers, especially scarlatina, or when it occurs in the scrofulous diathesis, as it frequently does, it is often of longer duration than in other circumstances, or when it appears epidemically; and it more readily passes into suppuration of a chronic kind, the matter being discharged externally, and but rarely by the external meatus auditorius. In the *epidemic* disease, perspiration usually breaks out on the fourth or fifth day, commencing and becoming more copious about the neck, breast, and head, but often extending more generally. The pain, tension, and swelling of the parotids afterward diminish, and the affected parts return to their natural state.

9. *c. Suppuration*, which is more frequent in the *simple*, in the *consecutive*, and in the *scrofulous* states of the disease than in the epidemic, is commonly indicated by a greater intensity of the local symptoms; by marked redness of the more swollen part; by a more central and circumscribed elevation; by the pain being less acute and more throbbing; by the more elevated part of the tumour becoming softer, and ultimately betraying more or less evident fluctuation. The cellular tissue surrounding the gland or connecting its lobules is generally the seat of suppuration. Bichat and others have supposed that the lymphatic glands surrounding the parotids are more affected than the parotids themselves; and this may be the case, especially in the *consecutive* (§ 11) and *scrofulous* varieties of the disease. Probably, also, in the *epidemic form*, these parts, with the glands themselves, and the adjoining cellular tissue, are more or less implicated.

10. *d. Metastasis* of disease from the parotids to the testes, mammæ, or even to the brain or its membranes, has been often observed and noticed by writers as one of the terminations of the disease, especially when appearing epidemically. When this occurrence takes place, the swelling under the ears rapidly subsides, and either the testis or the mamma on the same side with the affected parotid becomes painful and swollen. When both parotids have been affected, the metastasis has in rare instances taken place to both testes or to both mammæ. I have not met with a case in which suppuration has occurred in these parts after metastasis from the parotids. In some instances the parotids have become again affected upon the subsidence of the engorgement of the testicle. I have observed but few instances in which the brain or its membranes have been affected consecutively upon the sudden disappearance of the disease of the parotids; and these recovered under the treatment about to be noticed.

11. *C. The nature* of inflammations of the parotids, in their several modes of manifestation, requires more consideration than has hitherto been devoted to it. That the *epidemic state* of the disease is different in many respects from the primary and simple form is shown by various circumstances, to which I will more particularly allude.—*a. Simple parotitis*, whether occurring *primarily* from cold or any other cause, or *consecutively* of eruptive fevers, or of other affections implicating the throat or mouth, is more distinctly an inflammatory disease, and is more strictly local than the *epidemic* malady. It is also more prone to assume all the characters of inflammation of glandular parts, and to pass into suppuration, than the latter form.

12. *b. Epidemic parotitis* is less strictly inflammatory, at least in a large proportion of cases, and is more manifestly congestive; consisting rather in active congestion, or an engorgement of the parotids and adjoining glands, than the simple form of the disease. It is also less a local than a constitutional malady; and this, as well as its more congestive character, is shown by its originating in infection, by its disposition to metastasis, by its definite course, and by its frequently terminating by a distinct crisis. The *simple* or sporadic complaint is attended by fever, which is merely symptomatic of the local inflammatory action; while the *epedimic* is characterized by fever, which is less a symptomatic than a primary or idiopathic malady, and of which the swelling of the salivary glands is an attendant or local feature, consisting of congestion or engorgement of these glands rather than of actual inflammation. In the epidemic or specific form of the disease, the fever is rarely sthenically inflammatory, but generally is either mild, or partakes more of an adynamic or asthenic character, and requires a different

treatment from the truly inflammatory or simple form of the complaint.

13. *c.* From this it will be seen that I consider *Parotitis*, or inflammation of the parotid, to consist of the following *varieties* and *states: namely*, 1st. *Simple* or *Common Inflammation*, occurring, *a. primarily*, or independently of pre-existing disease; and, *b. consecutively*, or following eruptive fevers and affections of the mouth and throat, in both which states it usually presents an acute character; 2d. *Scrofulous Inflammation* of the parotids, or parotitis affecting the strumous diathesis, and usually assuming a chronic or indolent form; 3d. *Epidemic Parotitis*, or that proceeding from a *specific* cause, and presenting a *specific* or distinct and regular course. Indeed, it is doubtful whether this last should be arranged as a local inflammation, or rather as a specific form of fever caused by infection, and characterized by congestion or engorgement of the salivary glands, and a tendency to metastasis to the testicles, and thence to the brain.

14. ii. Treatment.—The treatment of inflammations of the parotid should vary with the severity of the local symptoms, and with the character of the attendant fever.—*a.* In the *simple form* of the disease, when *primary* and *slight*, moderate warmth, sustained by the application of flannel locally, and cooling aperients and diaphoretics, are generally sufficient to promote resolution. I do not believe that cold applications are beneficial in this complaint; they may even prove injurious. In more severe cases, where inflammatory action is unequivocally manifested in the gland and its vicinity, blood should be taken away locally, and a more strict and antiphlogistic treatment and regimen adopted, as in other cases of inflammation. If suppuration commence, it should be promoted by the usual warm applications, and an early outlet be given to the matter which is formed.

15. *b.* In the *consecutive form* of *parotitis*, particularly that following the anginous states of eruptive fevers, even local depletion should be cautiously prescribed, and with strict reference to its effects. Diaphoretics, stomachic aperients, warm baths, and diuretics are generally required in these circumstances; and if the swelling become sub-acute or indolent, small doses of the iodide of potassium, with liquor potassæ, may be given in the compound decoction of sarsaparilla. If suppuration take place, the matter should be early evacuated, and the iodide and solution of potash may be given in the decoction of cinchona, &c., and change of air, especially to the seaside, advised.

16. *c.* The *scrofulous*, sub-acute, and chronic states of parotitis sometimes require the application of a few leeches to the parts, or to their vicinity, and the means just recommended (§ 15) firmly persisted in for a considerable period. Brandish's alkaline solution may be substituted, in many cases, for the solution of potash. When there is some degree of anæmia, or when the affection occurs in females about the period of puberty, with delayed or scanty menstruation, the iodide of iron may be taken in the sirup of sarsaparilla, and warm salt-water bathing, or warm salt-water hip baths resorted to.

17. *d.* The *epidemic form* of the complaint is so slight in some cases as to require merely protection from cold and humidity, and attention to the state of the secretions and excretions. The affected parts ought to be kept moderately warm, and the excretions from the bowels and skin promoted. When the local affection is more decidedly inflammatory, the swelling of the neck being considerable, and the surface generally red, febrile action being also great, a number of leeches may be applied, and their operation promoted by warm fomentations. Cold applications are especially hazardous in this form of the complaint, as favouring metastasis to the testes; and this risk may even be incurred by active purgatives. Antimonial diaphoretics and gentle aperients are the safest means which can be employed in most cases of this affection. If metastasis to the testicles or to the mammæ occur, these are also the best remedies, in connexion with the horizontal posture. In these secondary states of disease, the application of leeches, followed by warm fomentations and poultices, is generally necessary. Antimonial emetics are often of service in inflammation of the testes; but when this disease occurs suddenly upon the disappearance of parotitis, the subsequent metastasis of the malady to the brain should be dreaded, as it sometimes takes place; and it may be favoured by the active operation, and consequent perturbation of emetics, and by the application of cold to the diseased testicles.

18. It is possible that parotitis, caused by cold and humidity, may assume an endemic form, or may affect a number of persons who are exposed to these causes, or exist in a particular locality. It has thus affected a considerable number of a ship's crew, and it has then manifestly arisen from the once general practice of daily, and even more frequently, washing the decks, now happily abandoned. The cold and humidity produced in a confined space by this practice were the sources of more maladies, especially of rheumatism, erysipelas, fevers, &c., than were recognised in those days. Mr. Noble, in his account of parotitis endemic in a ship of war, states that the swelling and redness of the neck suddenly subsided on the fourth and fifth days, and were in all the cases rapidly followed by metastasis to the testes, the epididymis and spermatic chord not being affected. In two instances a second metastasis took place from the testes to the brain, the cerebral symptoms being well marked and severe. In no instance did the disease return to the parotids. This remarkable frequency of metastasis was probably favoured by the persistence of the cause originating the disease, and by the use of cold applications and drastic purgatives.

19. *e.* In some instances, especially in aged persons, or in females about or soon after the change of life, the complaint assumes a *chronic state*, obscure inflammation extending to the adjoining cellular tissue, and giving rise to the formation of matter, and even to indolent ulceration, if a suitable treatment be not employed. In these, a few leeches should be applied, and sometimes repeated, and an antimonial emetic exhibited. Subsequently, antimonial diaphoretics may be given, and, if matter form, fomentations, poultices, and an early outlet to the matter are requisite. If the disease become

indolent, or if swelling and hardness remain, the iodide of potassium, with liquor potassæ and sarsaparilla, should be prescribed. The external application of a weak tincture of iodine, or of the iodide of potassium, in the form of ointment, may also be tried; but I have seldom seen this ointment beneficial unless the proportion of iodide has been much smaller than that usually prescribed. Dr. Neumann (*Edin. Med. and Surg. Journ.*, No. 93, p. 452) applied a plaster, consisting of eight parts of mercurial ointment, and one of the iodide of potassium, to the swollen gland with great success, during an epidemic parotitis which prevailed in Silesia, having premised an emetic. When parotitis, either simple or epidemic, occurs about the period of puberty, and previous to menstruation, it is apt to become obstinate and chronic, particularly in scrofulous habits. In these cases, the iodides combined according to the peculiarities of the case; local depletion, emmenagogues, horse exercise, warm salt-water bathing, stomachic aperients, &c., are most serviceable.

III. Organic Lesions of the Parotids.

Classif.—IV. Class, I. Order (*Author*).

20. Structural lesions of these glands, both the consequences of inflammation and independent of this state of disease, are sometimes observed. The most frequent and important of these are enlargements, scrofulous disease, scirrhus, and open carcinoma. To these may be added the congestions and asthenic inflammation, sometimes terminating in sphacelation, occasionally observed in malignant fevers, and frequently in the plague.

21. *A. Chronic enlargement* of the parotid, without pain, heat, or any other indication of inflammatory action, is sometimes met with. In some cases the gland increases to three or four times its natural size. It is difficult to determine how far hypertrophy is owing to change in the lobular structure, or minuter granules composing the gland, or to deposites of lymph in, or change in the nutrition of, the interlobular and surrounding cellular tissue. Most probably both orders of structure, and even the surrounding lymphatic glands, are more or less implicated; and this seems the more likely, since the researches of Murat and others have shown the granules and minute lobules of the gland to be affected in parotitis. A very remarkable case of chronic enlargement, first of one parotid, and afterward of the other, the first having become much reduced after a considerable time, lately came under my care. The history of this case, as well as of others which I have seen, led me to infer that the enlargement was consequent upon obstruction or obliteration of the canal of the duct. After having had recourse to a variety of means, the enlargement was at last entirely removed by a prolonged course of the iodide of potassium in minute doses with conium. In this instance, from half a grain to a grain only of the iodide was given in the twenty-four hours, a larger dose occasioning uneasiness and febrile excitement.

22. The symptomatic enlargements, congestions, asthenic inflammations, softenings, and even gangrene, sometimes observed in malignant fevers and the plague, were imputed by Bichat and others rather to alterations in the connecting and surrounding cellular tissue and lymphatic glands than to change in the granules of the gland itself. But the researches of Murat and others have shown that these granules are affected from the commencement of simple parotitis, while those of Bulard and Clot-Bey have evinced that the surrounding lymphatic glands are more especially implicated in the plague, and in other sympathetic enlargements in the region of the parotids.

23. *B.* Tumours of various kinds are sometimes seated in the parotid, and scirrhus and open cancer, commencing either superficially or in the gland itself, or in the lymphatic glands surrounding the parotids, are occasionally met with. These have been the themes of prolonged surgical disquisitions, as well as the subjects of surgical operation. But in this last resource the dexterity or daring of the operator has been oftener displayed than the propriety and success of the undertaking. Comparatively few cases admit of this procedure—in very few ought it to be attempted when the disease is malignant; and in none of a non-malignant nature, without having previously duly tried the means already indicated both in this article and in those on Scrofula and Tumours. (*See arts.* Saliva, Salivary Ducts, and Salivation.)

[It is very important, in the treatment of tumours situated in the parotid region, as well as other parts of the body, to allay all mental anxiety, as it is found that disquietude of mind and perturbation of spirits are powerful causes in promoting morbid growths. As they generally have their origin in mal-assimilation, or faulty secretion and excretion, it is of the first importance to shape our remedies with these ends in view; for, without attending to these functions, local applications will be altogether useless; and even should the tumour be removed, similar deposites will take place in other parts of the body. If the healthy functions of the various secreting organs can be maintained, there is every probability that morbid growths will eventually disappear; at any rate, they will rarely become malignant, or call for a surgical operation. We have for several years been in the habit of treating tumours *medically* rather than *surgically*, and we have met with but very few cases in which extirpation was called for. Where a tumour is so situated as seriously to disturb the functions of parts essential to life, as over the trachea, or within the mouth and about the jaws, its removal becomes not only justifiable, but absolutely necessary. It may be that the presence of the tumour, although not malignant, is the cause of continual apprehension on the part of the patient, which cannot be allayed except by its removal; here it will be in vain to attempt to check its growth by local or constitutional means, and it may, therefore, with propriety be extirpated. By strict attention to hygienic regulations, air, food, exercise, and bathing, with a mild, alterative course of iodine and sarsaparilla, we shall succeed, in a large majority of cases, in allaying the pains and checking the growth of tumours, if we do not succeed in effecting their entire removal by absorption. We agree with our author that a surgical operation in the first resort is never advisable, except under the circumstances above detailed].

Bibliog. and Refer.—*O. Valentini*, Discorso Med. Chirurgico intorno alle Parotidi nelle Febbri. Perug., 1736. —*E. G. Schmidt*, Abhandl. von den Geschwulsten am Halse, &c. Brauns., 4to, 1755.—*Rochard*, in Journ. de Médecine, t. vii., p. 379, 1754.—*M. Stoll*, Rat. Med., p. iv., p. 263.—*Mariotti*, Delle Parotidi ne' Mali Acuti, 8vo. Perug., 1785. —*R. Hamilton*, Account of the Mumps, Trans. of Roy. Soc. of Edin., vol. ii., 4to. 1790.—*J. B. Siebold*, Hist. Systematis Salivalis Physiol. et Pathologice considerati, &c., 4to. Jena, 1797.—*A. L. Murat*, La Glande Parotide consid. sous ses Rapports Anatom., Physiolog., et Pathologiques, 8vo. Paris, 1803.—*J. Noble*, in Edin. Med. and Surg. Journ., vol. iv., p. 304 (*Endemic*).—*A. Duncan*, in Edin. Med. and Surg. Journ., vol. vii., p. 431 (*Epidemic*). —*Murat*, in Dict. des Sciences Méd., t. xxxviii., art. *Oreillon*; et t. xxxix., art. *Parotide*.—*E. Gendron*, Mém. sur les Fistules de Glande Parotide, 8vo. Paris, 1820.—*Hammersley*, in New-York Medical Repository, July, 1822, p. 443.—*Rochoux*, Dict. de Méd., t. xvi., art. *Parotide*.—*Begin*, Dict. de Méd. et Chir. Prat., art. *Parotide*.—*W. Kerr*, Cyclop. of Pract. Med., vol. iii., p. 260.—*A. Duplay*, Observat. de Parotides survenus dans le Cholera, in Archives Génér. de Méd., t. xxix., p. 365. 1832.

[For an account of American operations for the removal of the parotid gland, see Reese's edition of Cooper's Surgical Dictionary, p. 259].

PELLAGRA.—Synon. *Dermatagria*, Titius. *Scorbutus Alpinus*, Frank. *Ichthyosis Pellagra*, Alibert. *Tuber Pellagra*, Parr. *Lepra Lombardica*, Swediaur. *Elephantiasis Italica*, Good. *Pellagre*, Fr. *Pellarella*, *Pelagra*, *Mal di Miseria*, *Malattia della Miseria*, *Mal del Sole*, *Mal Roso*, Ital.

Classif.—*3d Class*, *4th Order* (*Good*).
IV. Class, IV. Order (*Author*).

1. Defin.—*A squamous eruption, chiefly on those parts of the body exposed to the sun or air, preceded and attended by disorder of the digestive organs and nervous system; accompanied with general cachexia; a sense of burning pains in the trunk and limbs; ennui and melancholy; intermitting at first, afterward more continued; endemic and hereditary.*

2. The *antiquity* of Pellagra has been a subject of doubt. Moscati and others consider that the disease has not been known much before the middle of the last century, while Strambio, who was physician and director of the hospital established near Milan for the reception of *pellagrosi*, states, in his treatises published in 1784–7, that he had seen many *pellagrosi* in the hospital, who assured him that their fathers and grandfathers had died of the malady. Dr. Holland adds, that F. Frapoli, physician to the hospital at Milan, in his treatise on the disease, published in 1771, also contends for its antiquity, and supposes it to be the same disorder as the one called *Pellarella*, which is casually noticed in the records of the Milan Hospital for the year 1578. It is certain, however, from the concurrent testimony of all writers on the malady, that pellagra has been rapidly increasing itself since the middle of the last century. Dr. Holland, who has investigated the disease more closely than any English writer, remarks that, at the time when Strambio wrote (in 1784), the pellagrosi formed about one twentieth part of the population in the districts principally suffering under the disorder, namely, in the Alto-Milanese, where the country rises towards the Alps. In these districts, Dr. Holland believes, at the time when he wrote (1817), the pellagrosi to be one in every five or six of the population. He adds that the disease prevails in some districts much more than in others; that it appeared first in the higher parts of the Milanese territory, and that its ravages there are still greater than in any other part of Lombardy. Some time elapsed before it was said to have appeared in the Venetian provinces and near the shores of the Adriatic Sea. At the present time it is increasing in every part of Lombardy, as well on the plains as among the hills which rise on their northern border towards the Alps. It also exists in the province of Friuli, the district intervening between the foot of the Carinthian Alps and the northern shore of the Adriatic.*

3. I. Symptoms.—Pellagra is almost exclusively confined to the lower orders, and chiefly to peasants, and those engaged in agricultural employments.—*a*. Its first distinct appearance is that of a local cutaneous eruption, generally preceded by languor, debility, and indications of constitutional disturbance and cachexia. The local symptoms usually first appear early in spring, when the midday heat is increasing, and when the peasants are most actively engaged in the fields. The patient first perceives on the backs of his hands, on his feet, and more rarely on other parts of the body exposed to the sun, certain red spots or blotches, which gradually extend themselves, with a slight elevation of the cuticle, and a shining surface, not unlike that of lepra. The colour of the eruption is a more obscure and dusky red than that of erysipelas: it is attended by no other uneasy sensation than a slight pricking or itching, and some tension in the part. After a short time, small tubercles are frequently observed in the inflamed surface. The skin always becomes dry and scaly, forming rough patches, which are excoriated and divided by furrows and rhagades. Desquamation takes place gradually, and leaves behind a shining, unhealthy state of the affected surface. Towards the close of the summer, or occasionally earlier, the parts have nearly resumed their natural appearances; and but that the farther progress of the malady is familiar to all, the patient might suppose that the mischief had disappeared.

4. With this local affection are connected from the first, general debility, vague and irregular pains of the trunk and limbs, especially in the course of the dorsal muscles and spine; vertigo and headache; irregular appetite and depression of spirits. The bowels are usually relaxed, and continue so throughout the disease. There are no febrile symptoms, and the catamenia of females are generally continued without irregularity; but there are frequent exceptions; febrile symptoms occasionally appearing, and menstruation being more or less obstructed from the commencement; but these occur chiefly in the more advanced course of the malady.

5. The patient obtains a remission, more particularly of the external eruption, during the autumn and winter of the first year; but he almost always experiences a recurrence of the symptoms in the following spring under a more severe form, and with much greater disorder of the constitution. The cutaneous affection spreads, yet still affecting chiefly the hands, neck, feet, and legs, and other exposed parts. The skin becomes callous and deeply furrowed; large rhagades appearing, especially near the

[* M. Gibert considers the pellagra of Lombardy to be merely an ichthyosis dependant on a chronic affection of the digestive organs. As it is a disease to which the inhabitants of our country are fortunately strangers, we shall add nothing to the very full and complete history of the disease given by our author.]

articulations of the fingers. The cutaneous affection now resembles an inveterate degree of psoriasis, or of lepra vulgaris, and, in some respects, ichthyosis, with which Alibert has classed it.

6. The debility is greatly increased in the second year, often rendering the patient incapable of pursuing his active labours, and rendering him susceptible of all changes of temperature. Partial sweats break out, especially on any exertion. Cramps, spasmodic affections, and pains are frequently complained of; and the mind is despondent and depressed. All the symptoms are aggravated as the heat of summer advances, especially in those most exposed to the sun. They begin again to decline, as in the preceding year, towards the middle or end of autumn; but the remission, as well of the local affection as of the general disorder, is much less complete than before; and the patient continues to suffer during the winter from debility and other constitutional symptoms.

7. The disease may continue for several years thus to remit during winter, and to present increasing or varying grades of exacerbation during the spring and summer, but generally in the third year, or in the fourth or fifth, in some instances, or even later, every symptom is renewed at an earlier period of the spring, and in an aggravated degree. The debility now becomes extreme; the patient is hardly able to support himself; and he is affected with pains in his limbs. All the constitutional phenomena indicate universal cachexia and lesion of the nervous and voluntary powers; the general symptoms now have a close analogy to those of scorbutus. The diarrhœa continues, and augments the debility; and ultimately it assumes much of a dysenteric character, particularly in the latter stages of the malady. The evacuations are offensive and morbid, and preceded by abdominal pains. Aphthæ, thirst, pains at the stomach, &c., are also frequently complained of. The odour of the breath and of the perspiration is extremely offensive. The appetite and digestion are irregular; but they are often less affected than most of the other functions. Dropsical effusions frequently appear at this stage, generally in the form of anasarca, occasionally of ascites. Vertigo, tinnitus aurium, double vision, are now usually present; and all the senses are much impaired. Spasmodic affections, irregular convulsions, involuntary movements of the head and body forward, and even complete epileptic attacks, often occur.

8. *b.* The *nervous system* presents remarkable disturbance, and the manifestations of the mind are more or less disordered. The pellagrosi complain of a sense of heat in the head and spinal chord; of tingling or darting pains in the course of the nerves; of heat in the limbs, palms of the hands, and particularly in the soles of the feet; of great weakness of the limbs, with trembling when attempting to stand; and sometimes of contractions of the lower limbs. Their looks become sombre and melancholy. Ennui, depression of spirits, and mental imbecility increase with the progress of the malady. Dr Holland states, that pellagrosi afford a melancholy spectacle of physical and moral suffering at this period. They seem under the influence of an invincible despondency; they seek to be alone; scarcely answer questions put to them; and often shed tears without obvious cause. Their faculties and senses are impaired; and the disease, when it does not carry them off from exhaustion of the vital powers, generally leaves them incurable idiots, or produces attacks of mania, soon passing into utter imbecility or idiocy. The public hospitals of Lombardy are incapable of receiving vast numbers of the pellagrosi; the greater proportion perishing in their own habitations, or lingering there wretched subjects of fatuity and decay. Where extreme debility and cachexia are the causes of death, as is usually the case, they are attended with colliquative diarrhœa, spasmodic affections, coma, and extreme emaciation.

9. *c. Mania* and *delirium*, consequent upon pellagra, are either *acute* or *chronic*. The acute state sometimes proves fatal in a few days; but the more chronic form seems to retard, in some degree, the progress of the malady, the strength of the patient declining less rapidly. In this state there is always loss of memory and of the powers of attention. Religious melancholy frequently characterizes this form of delirium, with a desire to commit suicide, and usually by drowning. Hence Strambio denominated this morbid disposition by the name of *hydromania*.

10. *d.* Although the disease has been described above as proceeding in its course three or four years, yet it is generally of longer duration. Several intermissions, or remissions, usually occur in its progress. It occasionally remains stationary; and certain of its phenomena sometimes predominate over the others at one time, and others at another time Thus some relief of his sufferings is experienced by the patient from time to time, although he can entertain little hope of ultimate recovery. Occasionally the cutaneous eruption forms the principal indication of the complaint for several years, it being renewed every spring and disappearing in the autumn. The constitutional symptoms may also continue for some years comparatively slight; and, if the patient be removed to a different locality and to another mode of life, the disease may be farther protracted, or altogether arrested in its progress. It is rarely, however, that these means can be adopted; and the constitutional malady is generally so firmly established in the third or fourth year, that few hopes of benefiting the patient by treatment or by change of climate and occupation can be entertained.

11. *e.* Some cases of the disease assume a more *acute* and more rapid form, particularly in respect of the constitutional symptoms. In these the disease proceeds as rapidly as above described, with all the more severe symptoms; and, although the pulse is often very slow and weak, especially in the more chronic cases, it is sometimes frequent and hard in the more acute. This, however, only occurs when fever takes place in the progress of the malady. This consecutive fever is connected either with a state of gastro-intestinal irritation, or of asthenic inflammation, or with predominant affection of the brain and spinal chord; and is generally attended, at first, by heat of skin and irregular remissions, followed by offensive perspiration. These states of febrile excitement

generally hasten the fatal termination of the malady, usually with all the concomitant symptoms of the last stage of adynamic fever.

12. *f.* In *infants* and *children* the symptoms of the malady are not materially different from those characterizing it in more advanced life. The cutaneous affection of the hands, arms, feet, and legs is the first to appear; is renewed and augmented in successive years, and attended by the various symptoms indicative of a cachectic state of the body. The malady, as in other cases, has in them a fatal termination, unless a change of climate be obtained in an early period of its progress.

13. *g.* Some *anomalies* have been observed in the progress and succession of the symptoms of pellagra. During its first appearance in Italy, the disease was remarkable for the intensity of the cramps and spinal pains, and the trifling extent of the cutaneous affection. At a more recent period this affection became a prominent feature, while disorder of the digestive organs and mania appeared chiefly as secondary symptoms. Different phenomena have also sometimes predominated; in certain years ptyalism, and in others it has been displaced by aphthæ, desquamation of the lips, &c. Very recently the various cramps, spinal pains, and convulsions, insisted on by former writers, have been less noticed than previously, while pellagrous mania and delirium are very common, and gastro-intestinal affections are general.

14. *h.* Pellagra may be *complicated* with other diseases of the skin, such as lepra, psoriasis, erysipelas, eczema, purpura, syphilitic eruptions, &c.; and with intermittent and remittent fever, scrofulous affections, phthisis, peritonitis, white swellings of the joints, &c.

15. II. Appearances on Dissection.—Lesions are found chiefly in the digestive canal, nervous system, and skin.—*a.* In the five bodies examined by M. Brierre de Boismont, the mucous membrane of the *stomach* was red, intersected by bluish or dark vessels, soft, pultaceous, and easily removed. The redness was greatest at the large end of the stomach; the mucous membrane was thinner in some cases, and thicker than natural in others. The valves of the duodenum, and the mucous membrane of the small and large *intestines*, were of a lighter or deeper tint, in some approaching to brown. This membrane was generally softened and hypertrophied; it was likewise studded with irregular or round ulcers, surrounded by a reddened base. The subjacent cellular tissue and muscular coat were hypertrophied. The intestines, in all the cases, contained lumbrici. Dr. Carswell, in addition to the usual signs of chronic inflammation of the stomach and intestines, found perforations of the stomach from softening in two cases.

16. *b.* The membranes of the *brain*, particularly the arachnoid and pia mater, in these cases, as well as in those examined by Strambio, Fantonetti, and others, were injected, thickened, and opalescent. The pia mater adhered to the cerebral convolutions, which were slightly atrophied. The substance of the brain was in some cases diminished, in others increased in consistence; the gray substance was injected and deeply coloured; the white substance dotted with vascular points. The cerebellum was slightly injected and somewhat softer than natural. The arachnoid and pia mater of the *spinal chord* were also injected. The gray substance of the chord was somewhat indurated and injected. The white substance was much softened.

17. *c.* The *skin* of the backs of the hands and feet was like leather, and, when examined with a lens, presented a number of irregular cracks, crossing at acute angles, and placed closely, and sometimes implicating the whole thickness of the corion. Small, thin, yellow crusts, and furfuraceous lamellæ of a dirty white, interposed in some of these small fissures, and adhered firmly. The epidermis was six or eight times thicker than natural, brownish, friable, and dry, and was firmly attached. The subepidermic layers were much thickened. The radial nerves were softened, reddish, and infiltrated with serum. The most frequent lesions to the above were the usual signs of recent or of old, general or partial *peritonitis*. Indications of *bronchitis* and *pulmonary tubercles* were also often observed. Enlargements of the *spleen* and of the *liver*, in some cases also of the mesenteric glands, and effusion of serum in the shut cavities, have been occasionally noticed.

18. III. Asturian Pellagra — *La Rosa—Mal de la Rosa — Asturian Leprosy*, Thierry, Sauvages, &c.—*Elephantiasis Asturiensis*, Good —is, according to the descriptions of Thierry and others, merely a variety of pellagra, and, in its local and general characters, still more nearly approaches the *leprosy of the Middle Ages* than the pellagra of Lombardy. Thierry states that this disease generally appears at the spring equinox, on different parts of the body, with redness and harshness of the skin. It afterward degenerates into rough, dry, blackish crusts, intersected by deep cracks and fissures. These dry and fall off in summer, leaving reddish, smooth, and shining marks, devoid of hair, and depressed below the level of the surrounding skin, resembling the cicatrices of burns. They remain through life. In the spring of every year they are covered anew with crusts, which become more and more painful, offensive, and disgusting to the sight. They often appear on the fore, or most exposed part of the neck, extending to the clavicles and top of the sternum.

19. To these eruptions are added a constant shaking or trembling of the head and upper parts of the body, heat of the mouth, vesicles on the lips, foulness of the tongue, extreme weakness of the whole body, with a feeling of heaviness, and disorder of the digestive organs Through the night, burning heat, insomnia, groaning without obvious reason, dejection of spirits, melancholy, &c., are complained of. Several suffer slight delirium or bebetude of the senses, particularly of touch and smell. To these are sometimes added slight mania, erysipelas, ulcers, and irregular fever. This malady is often attended, in its advanced stages, with a tranquil state of mania or melancholia. The patient sinks into a state of dejection, in which he forsakes his home, seeks solitude, and is reduced to utter despair. This mental depression usually appears about the summer solstice, and proves fatal sooner or later. A fatal issue is often, also, preceded by

marasmus and dropsical effusion. The local and constitutional symptoms place this malady in a position intermediate between the pellagra of Lombardy and the leprosy of the Middle Ages, although more closely to the former than to the latter.

20. IV. Diagnosis.—Pellagra is manifestly allied, in many of its features, to the leprosy of the Middle Ages on the one hand, and to scurvy, with which, however, pellagra is sometimes complicated, on the other hand. But still, there is an alliance only in certain points. The resemblance, also, which it bears to *erysipelas*, led Titius to define it as a chronic, periodic, and nervous form of that disease; from which, however, it differs widely in its whole history—in local and constitutional symptoms, in its nervous characters and terminations.

21. M. Mayer observes that certain epidemics which have occurred in the north of Europe during the last three or four centuries, and which have been generally attributed to want and to the use of unripe, spurred, and damaged grain, closely resemble pellagra. The resemblance is certainly close in many features, but the difference is great in others. There can be no doubt that local, external, and constitutional diseases, peculiar in kind or anomalous in character, yet varying in numerous modes, grades, and phases, appear in certain localities and at certain epochs, as the several circumstances and agents occasioning them are differently combined, in respect both of the number, grade, and quality of these agents; for it is only reasonable to infer that as causes, agents, and influences are variously associated in number, intensity, and quantity, so will the effects be different, and hence present indescribable forms, varieties, states, and phases, which admit not of distinct or specific limitations as to character, nor of consistent, constant, and uniform manifestations.

22. *a.* It will appear in the sequel (see *Causes*) that many of the circumstances in which the Italian and Asturian pellagra originate are the same which gave rise to the leprosy of the Middle Ages, and to certain epidemics which have appeared in several countries during the fifteenth and sixteenth centuries. Still, the features of each vary, or even differ. In the true *leprosy*, the face, roots of the hair, palate bones, nose, are more affected, and the cutaneous disease is more decidedly tubercular; the affection of the skin, of the extremities and face, increasing with the other symptoms, and the mind being less disordered than in pellagra. In the *Italian pellagra*, the mental, nervous, and intestinal affections predominate with the progress of the malady.

23. *b.* In the *Asturian malady;* the affection of the skin is greater than that of the Italian, and approaches more nearly the severity of leprosy; the affection of the mind is less acute than that of true pellagra, but the *termination* of all these is nearly equally unfavourable, although their *duration* is very variable, not only in regard of the respective maladies, but as respects individual cases of each.

24. *c.* The history of pellagra sufficiently distinguishes it from other diseases of the skin. Chronic *erythema* is never attended by the serious nervous, mental, and digestive disorders characterizing pellagra; and *lepra* and *psoriasis* are removed to an equally great distance from the Italian malady, even without taking into account the different characters and forms of the eruption in each, and the ultimately fatal issue of pellagra.

25. *d.* M. Rayer attempts to establish a similarity between pellagra and the epidemic of Paris and its vicinity in 1828, to which the name *acrodynia* has been given. But, although the season of the appearance of the latter was the same as of the former, and although the eruption on the extremities, the pains in the feet and difficulty of walking, the disorders of the digestive organs, closely resembled the same phenomena at an early period of pellagra, yet the absence of the mental disorder, the non-recurrence of the malady, and the general recovery of the attacked, indicate a total difference between the two maladies, the points of resemblance being probably the results of a concurrence of certain causes contributing to the production of pellagra.

26. V. Prognosis.—The circumstances which render the prognosis of pellagra particularly unfavourable are the unequivocal operation of those causes to which this malady is attributed; the circumstance of one or other parent of the patient having died of it; an advanced period of its course; the poverty and agricultural occupation of the affected; previous disease, and the severity of the constitutional symptoms, particularly of the disorder of the digestive organs; general cachexia; emaciation, and mental disturbance; severity of the nervous symptoms, and especially the occurrence of mania, delirium, partial or general paralysis; and, at an early stage, the impossibility of removing the subjects of the malady to a different climate, or to other occupations. Pregnancy and lactation also exert an unfavourable influence on its course and termination.

27. VI. Causes.—The hereditary tendency of pellagra is fully admitted by all writers who have observed the progress or traced the origin of the malady. There can be no doubt of the disease being continued in succession through families, even the children of pellagrosi becoming affected, when much exposed to the sun and air, or early occupied in the fields. Writers have differed as to the respective liability of sex; but there seems to be no difference in this respect beyond what may be imputed to occupation and exposure. That these latter circumstances are chiefly productive of the disease cannot be disputed, inasmuch as those only who are subjected to them are affected by it. Doubtless, however, other causes co-operate; but *the influences to which persons thus occupied are alone exposed should be viewed as the chief agencies in developing the malady.* Some writers have supposed the climate to be the chief cause; but if this were the case, other persons besides agricultural labourers would become affected. This disease has also been attributed to the use of maize; but we do not find that maize has any similar effect in other or similar climates, where it is extensively employed as food. It has likewise been imputed to a rice diet; but the same remark applies also to this opinion. The imperfect and sometimes unwholesome nourishment; the want of animal food, and due proportion

of condiments and stimuli; the insufficient use of salt and other antiseptic substances; and the general wretchedness, privations, and filth of the field labourers in this part of Europe, to all which the malady has been attributed, may certainly concur, in some degree, in developing it; but even these conjoined cannot reasonably be inferred to be the real exciting causes of it, inasmuch as these causes are equally influential, and concur in similar grades of activity in other localities, without pellagra being the result.

28. After considering the various causes and their combinations to which this malady has been imputed, I infer that they may tend to aggravate its severity or to increase the predisposition to its appearance, but that other peculiar and endemic agencies are chiefly concerned in generating it. What these agencies are has not been demonstrated, nor do they, perhaps, admit of precise demonstration, but they appear to me to proceed from the soil and water of the locality. The use of water filtrating through certain or peculiar geological formations, or certain alluvial deposites; the labours of the peasants in fields which are saturated with moisture, or which have been inundated during the preceding winter; and the circumstance of those parts of the body which are most exposed, or most commonly immersed in the water and soil or earth which these labourers cultivate, must readily suggest themselves to the minds of those who reflect on the subject as the obvious exciting causes of the disease. That the influence of the sun is necessary to develop the cutaneous affection, may be admitted, and may be explained by the effects produced by its rays, or by the drying effects of the air upon the surfaces covered by the moisture of the soil in which the peasants are employed. It has been objected, particularly by Strambio, that, although the sun and free exposure to the air tend to develop more completely the cutaneous affection, still the constitutional symptoms appear and proceed their course, even when no such exposure is incurred, and when the eruption is either imperfectly or not at all developed.

29. Viewing, therefore, the nature of the water of the localities in which pellagra occurs, together with the state of the soil and the water saturating or inundating the soil, as the chief causes of the malady, it may be admitted that the other agencies, to which so much influence has been imputed by various writers, may in some degree contribute to develop and to aggravate the disease, especially the use of unwholesome food, as of sour or diseased rye bread, or of unripe maize or rice; dirty and ill-ventilated apartments; hereditary predisposition; the depressing passions; privations, misery, and exhausting indulgences. M. Spessa attributes considerable influence to the habit of the poorer inhabitants of passing the evenings, and even parts of the day during winter, in the dirty and unhealthy cow-houses and stables, by way of escaping from the cold. The effluvium, also, proceeding from the accumulated exuviæ of the inhabitants and cattle at the commencement of spring and of warm weather; and when these exuviæ are exposed and spread upon the soil as manure, and to which the field labourers are more particularly exposed, may not be without its influence, and even exceed that insisted upon by M. Spessa. But, seeing that those persons who are alone affected with pellagra are those only who are much exposed to the agencies to which I have attributed the malady, the inference that these agencies are the principal causes of it becomes inevitable.

30. It may be further added, that similar causes to those which obtain in Lombardy exist also in the *Asturias*, where a similar malady prevails. These are extreme poverty, with its attendants, bad and insufficient food; filth; crowded and ill-ventilated apartments; and agricultural pursuits in the deep and swampy valleys of the country.

31. That the malady should first appear, and be aggravated during spring and summer, can be accounted for by the exposure of the subjects of it at this season to its chief exciting causes, and to the influence of labour, conjoined with increased temperature, in exciting the circulation, and in throwing out, by means of the cutaneous excretion, the morbid materials accumulated in the blood, and disordering vascular action in the digestive organs, in the nervous centres, as well as in parts of the cutaneous surface.

32. VII. Treatment.—It is obvious that the chief means of remedying, or even of checking the progress of this malady, are change of the habits and occupations of those who have become subjects of it; change of climate, and removal of the several causes and influences to which it has been imputed, and particularly of those upon which I have above insisted on. The circumstances in which those are placed who become the subjects of pellagra very generally preclude the adoption of these measures, which, however, can be but of little avail at an advanced stage and confirmed state of the malady. When the nervous and constitutional symptoms are fully developed; when the cutaneous eruption is constant, extensive, and severe, and is attended by a peculiar, offensive effluvium or perspiration; when affections resembling or approaching to those of either chorea, convulsions, tetanus, epilepsy, palsy, mania, or melancholia appear; or when severe diarrhœa, or dysentery, or marasmus, or dropsy, or pulmonary disease occur, then removal or change of occupation, or medical treatment, is very rarely of avail; and even at an early stage medicines can produce but little benefit while the patient continues to be subjected to the several circumstances and influences originating the malady. In addition to wholesome and nutritious food, alterative, tonic, and antiseptic articles should be prescribed, aided by warm bathing and diaphoretics. The alkaline carbonates taken in tonic infusions, or in demulcent and bitter decoctions, or with emollient and narcotic substances, are generally of service; but the treatment should vary according to the various prominent affections which complicate the advanced stages of the disease.

33. For the affections of the *digestive canal* the decoction of Iceland moss; various emollients, with or without opiates or Dover's powder; fomentations and embrocations on the abdomen, and emollient and anodyne injections are requisite.

34. Affections of the *brain* and *nervous sys-*

tem, during the progress of this malady, admit not of a recourse to lowering means. In but few cases can local depletions even be prescribed with advantage; but, while tonics, antispasmodics, and alteratives, conjoined with anodynes, as circumstances may suggest, are administered, blisters may be applied to, or issues or setons inserted in, the nape of the neck; or even small bleedings in the more acute cases may be directed from this situation or behind the ears. In most of the nervous affections appearing in the course of pellagra, the preparations of opium, taken with camphor, or ammonia and aromatics, are of essential service, but chiefly as palliatives.

35. For the cachectic habit of body and cutaneous affection, alkalies and alkaline carbonates with sarsaparilla, particularly the compound decoction, in large quantity, or with antimonials; sulphureous warm baths, followed by frictions; milk diet, and attention to the several secretions and excretions, using those means which are most serviceable in improving and promoting them, are the measures which promise the greatest amount of benefit, which, however, can rarely be attained without the removal of the causes which occasion the disease. Even in an early stage of the disease, while these continue to operate, and at an advanced stage even, when these are removed, medical treatment is generally of little or only of temporary avail, at least as far as it has been employed by the Italian physicians.

Bibliog. and Refer.—*F. Frapoli*, Animadversiones in Morbum vulgo Pellagram appell., 8vo. Mediol., 1771.—*Odoardi*, D' una Specie particolare di Scorbuto, &c., 4to. Venet., 1776.—*M. Gherardini*, Della Pellagra Descrizione, 8vo. Milano, 1780.—*G. M. Albera*, Trattato delle Malattie dell' insolato di Primavera, volgarmiente dette della Pellagra, 8vo. Varese, 1781.—*C. Strambio*, De Pellagra, Observat. in Nosocomio Pellagrosorum factæ, 4to. Med., 1785; et Dissertazione sulla Pellagra, 8vo. Milan, 1794.—*Jansen*, in *Frank*, Delect. Opusc., t. ix.—*F. Fanzago*, Memoria sopra la Pellag. del Territ. Padovano. Padov., 8vo, 1789.—*J. Videmar*, De quadam Impetiginis Specie, vulgo Pell. nuncupata, 8vo. Med., 1790.—*P. Dellabona*, Discorso Comparativo sopra la Pellagra, l'Elefantiasi, e lo Scorbuto, 8vo. Venet., 1791.—*L. Soler*, Osservazioni che formano la Storia estata di Pellagra, 8vo. Venet., 1791.—*M. Thierry*, Observations de Physique et de Médecine en Espagne, 8vo. Paris, 1791.—*S. C. Titius*, Oratio de Pell. Pathologia, in *Frank*, Del. Opusc., t. xii.—*C. Allioni*, Ragionamento sopra la Pellagra, 8vo. Turin, 1795.—*Leraches de la Freutrie*, Recherches sur la Pellagre, 8vo. Paris, 1805.—*G. Cerri*, Trattato della Pellagra, 8vo. Milano, 1807.—*J. H. G. Schlegel*, Briefe einiger Aertze in Italien, ueber das Pellagra, 8vo. Jena, 1807.—*G. B. Marzari*, Saggio Medico-politico sulla Pellagra, 4to. Venez., 1810; et Letterc al Dr. Thierre sulla Pellagra, 4to. Treviso, 1812.—*A. Boerio*, Storia della Pellagra nei Carnovese, 8vo. Torino, 1811.—*G. Cerri*, Osservazioni intorno all' Saggio sulla Pellagra di Marsari, 8vo. Milano, 1811.—*V. Chiarugi*, Saggio de Ricerche sulla Pellagra, 8vo. Firenz., 1814.—*F. Fanzago*, Memorie sulla Pellagra, 8vo. Pad., 1815; et Istrusione Catechistica sulla Pellagra, 4to. Venez., 1819.—*H. Holland*, in Transact. of Med. and Chirurg. Society of Lond., vol. viii., p. 317.—*G. M. Zechinelli*, Alcune Riflessioni sullo Stato dello Pell., &c, 8vo. Pad., 1818.—*G. Di Filippi*, Memoria sulla Pell., 8vo. Nap., 1819.—*Jourdan*, Dict. des Sciences Médicales, t. xl., art. *Pellagre.*—*G. B. Marsari*, Della Pell. e della Maniera di estirp. in Italia, 4to. Venez., 1819.—*J. C. Strambio*, Natura, Sede, e Cagioni della Pell., 8vo. Milano, 1820.—*Lagneau*, Dict. de Méd., t. xvi., art. *Pellagre.*—*A. A. Spessa*, in Annali di Omodei, t. lxiv.—*J. Johnson*, Change of Air in pursuit of Health. An Excursion through France, Switzerland, and Italy, in 1829, &c., 8vo. Lond., 1831, p. 75.—*Briere de Boismont*, De la Pellagre at de la Folie Pellagreuse, 8vo. Paris, 1834.—*W. Kerr*, Cyclop. of Pract. Med., vol. iii., p. 262.—*Rayer*, Dict. de Méd. et Chirurg. Prat., t. xii., art. *Pellagre;* and Theoret. and Pract. Treatise on the Dis. of the Skin. Trans. by *R. Willis*, 8vo. Lond., 1835, p. 1162.

[Am. Bibliog. and Refer.—American editions of *Cazenave*, *Rayer*, and *Plumbe;* also, *Worcester* on Diseases of the Skin.]

PEMPHIGUS.—Synon. Πεμφιξ, πεμφιγος (a small blister or bubble), πυρετος πεμφιγωδες, Hippocrates and Galen. *Pemphigus*, Sauvages. *Febris Bullosa*, Vogel. *Bullæ, Bullosa Febris*, Morton. *Hidrou*, Piso. *Pompholyx* (Πομφολυξ), Willan and Bateman. *Typhus vesicularis*, Young. *Emphlysis Pemphigus*, Good. *Febris vesicularis, Febris Pemphigoides*, Auct. *Fièvre Bulleuse, F. vésiculaire*, Fr. *Wassenblasen, Blasenfieber*, Germ. *Penfigo*, Ital. *Vesicular Fever.*

Classif.—3*d Class*, 3*d Order* (*Good*). 4*th Order* (*Willan*). IV. Class, IV. Order (*Author*).

1. Defin.—*An eruption of transparent or yellowish bullæ of considerable size appearing in circular or oval erythematous patches, nearly corresponding in diameter with their bases; terminating by effusion of the fluid they contain, and by the formation of lamellar incrustations, or by excoriations.*

2. I. Description.—The various appearances assumed by this eruption have led to various divisions and denominations of it, according to the mode of its eruption (*Pemphigus simultaneus, P. successivus*)—to the number of the bullæ (*P. solitarius, P. confluens*)—to the greater or less rapidity of their course (*P. acutus, P. chronicus*)—to the existence or absence of fever (*P. pyretieus, P. apyretieus*)—and to the age of the patient (*P. congenitus, P. infantilis*). I agree, however, with Rayer, Cazenave, and Wilson, in the propriety of considering this eruption under the two heads of *acute* and *chronic.*

3. i. Acute Pemphigus.—*P. acutus, Febris bullosa, F. Pemphigoides, F. Synocha cum vesiculis*, Auct.—This is a rare disease. The bullæ almost always stand apart, or are distinct. They are rarely confluent, and they usually appear in succession. They may be partial or more or less general, and may occur on any part of the body, but most commonly on the lower extremities; occasionally, however, also on the arms, the trunk, and the face; most rarely on the soles of the feet, hairy scalp, and genitals.

4. *a.* The *constitutional symptoms* vary from a slight degree of languor and listlessness, sometimes of sickness and general uneasiness, followed by quick pulse and mild fever (*Pompholyx benignus* of Willan), to chilliness or rigours followed by a dry and hot skin with pruritus, by pains in the head and limbs, nausea, thirst, anorexia, tenderness at the epigastrium, very rapid pulse, sore throat, and even slight delirium. In some cases the fever is attended by irritation of the mucous surface of the digestive, respiratory, or genito-urinary organs.

5. *b.* The *eruption* usually appears the second or third day from the commencement of the constitutional disorder, or even later, in the form of small red spots, preceded and attended by pruritus, and a parched and hot sensation. The spots increase to circular or oval erythematous patches, varying in redness from a pale to a vivid or dusky tint. In the course of a few hours a vesicle arises in the middle of each patch, and becomes rapidly distended by a limpid serum, and increases to the size of a hazelnut, or even of a large walnut. The bullæ, or *blebs*, which thus arise are usually circular or oval, and slightly flattened at their summits.

They generally correspond with the breadth of the patches on which they appear, and thus conceal them; or they are somewhat smaller than the patches, which thus show around them as a narrow zone, more rarely as a complete areola. The bullæ usually break in a day or two, and expose an excoriated surface, secreting for a few days longer a serous fluid, which concretes into a thin, yellowish scab, and becomes gradually browner and dark; but they sometimes do not burst, and in this case the serum contained in the bullæ assumes an amber or yellowish tint, subsequently turbid and opaque, diminishing in quantity by evaporation, shrivelling and drying up, in the course of a few days, into a thin, dark scab. The rupture of the bullæ, and the time when it occurs, depend upon the situation of their eruption. In about three weeks the scabs fall off, leaving the skin beneath of a dusky red hue, but sound.

6. Bullæ are occasionally imperfectly developed, and appear in the form of circular or oval patches, slightly red and prominent. On passing the finger over their surface, the cuticle is felt loosened by a slight effusion of serum between it and the dermis. The cuticle is detached after a few days, exposing a red spot, covered by a thin and shining epidermic layer.

7. The *duration* of the disease depends upon the mode of eruption; if this takes place at once, it is no longer than just stated, or from seven to fourteen days; but if the bullæ appear successively, it is longer accordingly, or from three to four weeks. Mr. Wilson remarks that, in the progress of the cutaneous eruption, vesicles are not unfrequently observed on the mucous membrane of the mouth.

8. When the disease is *confluent*, two or more of the bullæ unite and form a *bleb* as large as a hen or a goose egg. In these cases the constitutional symptoms are more severe, and are sometimes attended by irritation of most of the mucous surfaces.

9. *c.* This disease sometimes affects *children*—*Pemphigus infantilis*—*P. gangrenosus* of some writers—and sometimes assumes a very serious or even fatal appearance. But this severe form occurs chiefly in lying-in hospitals, or in the crowded, dirty, and ill-ventilated dwellings of the poor. In the cases which I have seen in *infants* the bullæ were numerous, more frequently distinct than confluent, and, in a few instances, presenting many of the characters of *rupia escharotica*, but assuming much more acute features, and even terminating fatally in four or five days. When it occurs in lying-in hospitals, it may present a mild form in some cases, and a very acute and dangerous form in others, even in the same ward and at the same time. It then manifestly proceeds from local causes: from the states of the beds and bedclothes, and the air of the wards.

10. *d. Solitary Pemphigus*—*P. solitarius* of Willan—is very rare. I have seen only one case of it. The bulla rapidly attains the size of an orange. It is preceded by disagreeable sensations of tingling and smarting. The bulla breaks in about forty-eight hours, and is succeeded by a superficial excoriation, passing into slight ulceration. One or two days after the disappearance of the first bulla another arises in its vicinity, and pursues the same course as the preceding. In this way, two, three, or even more may appear in succession, the disease being prolonged to several days' duration. Willan says that this variety very rarely occurs, and seems only to affect women. The case I saw was in a man, and occurred on the lower extremity. Biett and Cazenave mention a chronic state of this variety.

11. *e. Acute Pemphigus* may occur as a *complication* or sequela of eruptive fevers, or be *associated* with other eruptions, as with herpes, and more rarely with prurigo. Mr. Wilson remarks that the small bullæ of pemphigus bear considerable resemblance to the vesicles of herpes phlyctenodes; and the likeness to herpes is still farther increased by the occasional appearance of the smaller bullæ of pemphigus in the form of rings.

[The following case of pemphigus, from Gibert, gives a very correct idea of the acute and accidental form of the disease:

"A man of sanguineous temperament, 21 years of age, in the habitual enjoyment of good health, went out hunting on the 8th of September, 1811, in the marshes of Bresse, and got, several times, up to his knees in water, being exceedingly fatigued, and in a state of great perspiration. On the following evening a general heat manifested itself, preceded by shivering, and accompanied by pain in the head, and thirst, increasing towards night. The second day, after a remission in the morning, the fever became greater towards the afternoon. The third day the face was more highly coloured, the skin burning hot, the pulse hard, quick, and incompressible. Pricking and itching sensations in the inferior extremities, which appeared slightly swollen, and of a deeper colour than the rest of the body. During the night, restlessness, extreme agitation, heat, and lancinating pains in the legs. The fourth day, the inferior extremities, swollen from the knees to the toes, were covered with red patches, upon which were raised vesicles (bullæ), transparent, of a yellowish white, full of serum, some the size of nuts, others that of almonds, and many merely that of pease, unequally scattered, smaller and more numerous on the feet and malleoli, larger and fewer upon the upper part of the legs. All the red patches are not yet covered with vesicles; on some the epidermis is scarcely, or not at all, raised. They formed a slight prominence, their colour not disappearing on pressure. Those which had vesicles in their centre were surrounded by a red areola, which became narrower as the vesicle extended itself. Between each of these patches the skin preserved its natural colour. The pulse, full and incompressible, beat less quickly than the previous evening; the eyes became painful, slightly red and watery; the tongue dry and whitish; the bowels costive; the urine high-coloured, and scalding. The other functions were unimpaired. Passed a comfortable night, and slightly perspired. The fifth day many of the vesicles increased in size; some on the calves of the legs became confluent. The sixth day, the larger elevations became less full; the epidermis shrivelled, and the fluid which they contained accumulated in the most depending part, when it dried up on their spontaneous or accidental rupture. During the seventh and eighth days, most of the vesicles, faded and shrivelled,

spontaneously opened, and poured out a quantity of yellow, inodorous, limpid serum, leaving their bases exposed, which formed large, red, and painful excoriations, and continued to ooze out a serous fluid for some period. The smaller vesicles did not break, but faded and dried up, becoming white and opaque. The red areola, at the same time, became obscure, and at length disappeared. From the eighth to the tenth day all the scales dried up, and were replaced, some by large, thin, yellowish scales, others (those which were not evacuated) by more thickened crusts. On the falling off of these concretions, which took place in two or three days, there remained upon the skin bright, shining, wine-coloured patches, but without any depth of cicatrix. The severity of the fever was arrested after the development of the eruption; it then became very slight, and returned no more after the sixth day. The urine then became turbid and deposited a considerable sediment. On the seventh day the bowels were relaxed, the stools being thin and frequent; they soon, however, became natural. For the first six days the patient did not leave his bed; on the seventh he left it, and made a good meal without any inconvenience resulting therefrom."]

12. ii. Chronic Pemphigus.—*Pompholyx diutinus*, Willan — *Phlyctenoide confluente*, Alibert—is met with much more frequently than the acute, and appears much oftener in adults and aged males than in females. It is either limited to a small surface, or spreads more or less over the body. It is painful and tedious in its course, always successive in its appearance, and affects chiefly persons advanced in age and of debilitated constitutions. It often continues for many months or even years, and in some cases appears at a particular season for several successive years; for instance, in the autumn and winter, and declining in the spring.

13. *a*. The *constitutional symptoms* of chronic pemphigus are slight compared with those of the acute; some degree of sickness and lassitude, with pains in the head, back, or limbs, precede the eruption during several days; and these symptoms generally vary in degree with the severity or extent of the eruption. The cutaneous disease is often associated with considerable gastro-intestinal irritation; and in aged persons, and in cachetic habits, it is sometimes attended by dysuria or hæmaturia.

14. *b*. The *eruption* appears first in the form of small red spots, attended by slight itching. The epidermis soon becomes elevated in the centre of each patch. The base of the elevation of the cuticle gradually extends; and often in a few hours an irregularly shaped bullæ, the size of a filbert, or even of a walnut, is thus formed. Sometimes the bullæ attain the size of an egg. At the end of three or four days some of the bullæ burst, discharge their contents, and leave an angry-looking excoriation of the dermis. In others of them, the serum becomes reddish and turbid, decreases, and dries up, forming a dark scab covered by the shrivelled epidermis. As one crop of bullæ is thus changed, another is produced near to the first; and the disorder thus may be seen in all its stages at the same time, and be prolonged, by successive eruptions, almost indefinitely. The bullæ are occasionally confluent, especially when they appear on the face; but this seldom occurs. They sometimes attain the size of the palm of the hand, the epidermis peeling off and exposing an unhealthy-looking excoriated surface, which seems difficult to heal, or which heals in two or three days, new bullæ forming and pursuing the same course as the former. In some severe cases the patient is confined to bed, but there is rarely any fever.

15. *c*. Chronic pemphigus may be *complicated* with *prurigo—Pompholyx prurigenosus* of Willan—and with various chronic diseases of the viscera, and in such cases may terminate fatally. It sometimes supervenes on chronic inflammation of the digestive organs, and on partial or general dropsy. When complicated with prurigo, it is often a most distressing affection, and in old persons especially may hasten a fatal termination, particularly if visceral disease be also present, as commonly observed.

[The following case from Gibert was called *eczema* in the first edition of his work, on the "Special Diseases of the Skin;" it is a good example of *pemphigus diutinus*, or the chronic variety of the disease:

"On the 26th of August, 1818, a woman 33 years of age was entered at the Hôpital St. Louis, tainted with a general cutaneous malady, which developed itself without any appreciable cause, and had lasted for 19 months. The commencement of this disease had been characterized by a bullous eruption, accompanied with itching; but for some time previous to her admission it had resembled the form of squamous dartre, *herpes squamosus maididans* of M. Alibert. The patient, whose skin constantly exhaled a fluid which penetrated and stained her linen, experienced no pain in a state of repose, except in the parts on which the weight of the body rested; but walking was impossible on account of the painful friction which it occasioned. For many months past the catamenia had not appeared. The whole surface of the body, with the exception of the palms of the hands and the soles of the feet, was covered with large, round, yellowish squamæ, under which the skin was rose-coloured, or even of a bright red. There was an abundant secretion of a slightly yellowish fluid under the squamæ, in many points. The hairy scalp was the seat of a desquamation which formed drier and more delicate scales; the sub-cutaneous cellular tissue of the neck was swollen, the skin being red, cracked, and shrivelled; the eyelids were red and deprived of their lashes. The mouth was dry, the tongue very red; it presented in the centre a slight coat of yellowish brown; nevertheless, the appetite and the digestive functions appeared unaffected. The pulse was slightly accelerated, the patient felt very weak, and had a slight cough. Laxative drinks having been exhibited for some days, gave rise to a slight purging; fever broke out, though in a very slight degree; the marasmus and weakness gradually increasing, the patient sank into an adynamic state, after 19 days of treatment and about 20 months of disease.

"On opening the body we found old adhesions in the chest, and some miliary tubercles in the two lungs (in other respects sound); a secre-

tion of calcareous matter in some of the bronchial glands. Two pints of a citron-coloured serum were effused into the peritoneal cavity, which, besides, presented some old filamentous adhesions, between the parietal and visceral portions of the membrane. The external surface of the large intestines, near their concave border, was studded with miliary tubercles. The internal surface of the intestinal canal was, generally, sound, with the exception of some slightly vascular injections in the stomach and colon. There was a quantity of yellowish-white fluid contained in the intestines, and particularly in the colon. The whole canal was shrunk and contracted, and the liver had assumed the *fatty* appearance: the gall-bladder contained a very small quantity of scarcely-coloured bile. The skin, covered with whitish squamæ, had quite lost its redness. This discoloration had already much diminished during life, since the intestinal affection and general debility had made so marked a progress."]

16. *d.* The contagious variety of pemphigus mentioned by Willan — *P. contagiosus* — is merely the symptomatic occurrence of bullæ in certain epidemic and endemic maladies described by authors. Its endemic occurrence has been observed by me on two occasions among infants in a lying-in hospital, on each occasion nearly all the infants in the institution becoming affected; but this prevalence was attributable to local causes, and not to contagion.

[M. Alibert has given, under the name of *dartre phlycténöide*, the following description of chronic pemphigus:

"There was, at the Hôpital St. Louis, a commissioner, named Pierre Roger, about 60 years of age. He was attacked with a *dartre phlycténöide*. It showed itself under the form of scattered pustules (*bullæ*) of the size of a nut, upon the trunk, also upon the anterior and posterior parts of the right shoulder, as though a scarf had been worn. The inner side of the arm was equally affected; the neck also, and the hairy scalp. These vesicles, filled with a transparent fluid, shrank, shrivelled up, and spontaneously broke, leaving the reticular tissue exposed. Some days after the drying up of the eruption the skin presented red patches, as if it had been burned with fire or with concentrated nitric acid. The itching was not very urgent, but there was a most uncomfortable feeling of tension over the whole skin. I noticed that all this supervened on a discharge of blood from the rectum. This man had been for a long time exposed to the vicissitudes of the season, and had been unable, owing to his distress, to procure himself even the necessaries of life.

"The same author has described under the same name a fatal case of *pompholix diutinus*.

"Anne Brundomy, 57 years of age, presented herself at the Hôpital St. Louis for treatment. She had suffered violent grief at the loss of her husband. One day, after having experienced some digestive disturbance, she was attacked with a spontaneous vesicular (*bullous*) eruption, which gradually extended over the whole surface of the integuments. These vesicles (bullæ) were oval, and multiplied so rapidly that they soon became confluent: they were not surrounded by any inflammatory areola. The eruption was accompanied by a general feeling of intolerable smarting and burning, which became less after it assumed a fatal aspect. *Phlyctænæ formed on the mucous membrane of the* mouth, æsophagus, and whole intestinal tube. The patient had a sensation of burning coals moving about in the intestines: she remained in this wretched state for 19 months, and at last sank, presenting for the last 15 days of her life all the symptoms of *continued adynamic fever*."]

17. *e.* The *morbid appearances* found in fatal cases are entirely those constituting the complications, and usually causing the fatal issue of this affection. M. Biett and Cazenave have often met with fatty liver in their examinations of these cases, with effusion of serum into the chest and other shut cavities.

[It has been stated that blebs, or bullæ, have been met with on the mucous membranes, and particularly on that of the pharynx of those persons who have died of this affection, but this is of very rare occurrence. On the contrary, these membranes will be generally found pale.]

18. II. Diagnosis.—The bullæ which occasionally appear during the progress of *erysipelas* are accidental, and are to be distinguished from those of acute pemphigus by the latter being distinct, the surfaces between them being neither tumid, nor red, nor painful. The isolated form of the bullæ and the laminated crusts which they form generally distinguish pemphigus from other eruptions. The bullæ of *rupia simplex* are exceedingly few, and terminate in ulcerations and in thick prominent scabs. In *ecthyma* the epidermis is sometimes raised by puriform fluid to a certain extent; but the purulent nature of the contained matter, the brownish appearance of the apex of the elevations, and the presence of pustules of ecthyma at an earlier stage, will sufficiently distinguish the eruption. In *herpes* the vesicles are always formed in groups upon a red and inflamed surface; while the bullæ of pemphigus are generally isolated, and free from surrounding inflammation. Even when the bullæ of pemphigus are small and confluent, so as somewhat to resemble *herpes phlyctenodes*, they are always larger than those of herpes, and some of them present their distinctive characters.

[It is generally easy to recognise pemphigus, if we except the chronic form of the disease, which somewhat resembles chronic *impetigo*, or even *pityriasis*, in its foliaceous desquamation. When it is chronic, and the bullæ are imperfectly developed, and particularly when there are nothing but squamous vestiges, or even consecutive stains, to establish a diagnosis, it requires some care and experience to distinguish the disease. In some instances it has even been *simulated* by placing small quantities of powdered cantharides on the limbs.]

19. III. The Prognosis of acute pemphigus, when occurring in adults, and without any complication, is always favourable. When met with in infants, in the circumstances above noticed (§ 9), it is often a serious or even dangerous disease. The prognosis of chronic pemphigus should depend upon the constitution of the patient, and upon the existence of visceral

disease. When it is extensive or frequently developed, and affects those debilitated by dissipation or poverty, or when it is complicated with visceral disease, an unfavourable opinion of the result should be entertained. Its severity usually corresponds with the cachectic state of the body affected by it. M. Rayer adduces a case in which chronic pemphigus of the legs, following attacks of hæmoptysis, appeared to exert a salutary influence. Where there is obvious visceral disease complicated with this eruption, the cure of the latter will aggravate and increase the danger of the former. Mr. Wilson remarks that he has seen several cases which have induced him to "believe that this eruption is an effort of the system to rid itself of some morbid disposition." I may add, that I have hardly seen a case in which there was not reason to infer, what I have elsewhere so much insisted on, a more or less morbid state of the circulating fluids, owing either to impaired elimination and excretion, or to imperfect assimilation.

20. IV. Causes.—Acute pemphigus attacks infants, children, and young persons most frequently. It has been said to be congenital and hereditary. It is most prevalent in the summer, and in those exposed to the sun's rays. I have often seen it in sailors who have exerted themselves under a tropical sun without any covering to the upper parts of the body. It is usually referred to teething; to improper or unwholesome food; to gastric and intestinal irritation; to over-feeding; to mental emotions; and to amenorrhœa and dysmenorrhœa. It has sometimes resulted from the constitutional irritation caused by vaccination. The endemic sources to which infants are sometimes exposed have been already noticed (§ 9). The symptomatic appearance of pemphigus, in connexion with various fevers, has been occasionally observed.

21. Chronic pemphigus occurs chiefly in aged persons whose systems are debilitated or cachectic, and appears most frequently in autumn and winter. It is usually caused by intemperate habits, by excesses, unwholesome food, by fatigue; anxiety of mind; low, damp situations; living in cellars and ill-ventilated apartments; exposure to cold; and by chronic irritation of the digestive, mucous, and genito-urinary organs. It is more rarely a sequela of the exanthematous fevers. It may follow disease of any of the secreting and excreting viscera, and thus be complicated with it, the morbid elements not being eliminated from the circulation, but irritating and inflaming the cutaneous surface in the particular mode constituting pemphigus; and often affecting, also, the mucous surfaces.

22. V. Treatment.—*A*. In the mild cases of *acute pemphigus*, but little more is requisite than to exhibit diluents, gentle aperients, warm baths, and diaphoretics, thereby to promote the functions of the several emunctories. When the symptoms are more acute, and the patient is plethoric, a few ounces of blood may be taken away, and purgatives, with the rest of the antiphlogistic regimen, prescribed. In infants, and in cases attended by debility or symptomatic of low fever, the infusion or decoction of bark, with muriatic acid, or with the alkaline carbonates, if the urine be very acid, is generally beneficial; and when any complication exists, especial attention should be directed to it.

23. *B. Chronic pemphigus* often withstands the use of very active means; but it is necessary, previously to determining upon the method of cure, to ascertain as nearly as possible the states of the secretions and excretions, and of the several emunctories. The urine should be carefully tested, and the alvine evacuations daily examined. When the biliary and intestinal functions are disordered, means appropriate to such disorder, as blue pill, or hydrarg. cum creta, with ipecacuanha or opium, or with Dover's powder, should be exhibited. In most cases, warm baths, either simple or alkaline, are of essential service. When the liver is torpid, after a recourse to calomel or milder mercurials, the nitric or nitro-hydrochloric acids may be given with the infusion or decoction of cinchona, or the decoctions of sarsaparilla. If the urine be acid, the liquor potassæ, with the preparations of sarsa, are generally beneficial; and, if the digestive mucous surface he exempt from marked irritation, small doses of the iodide of potassium may be added with great advantage. When there is marked disorder of the digestive organs, warm baths, alteratives, ipecacuanha, and anodynes are generally requisite. When the evacuations are offensive, as well as frequent, care should be taken not to confine the bowels by opiates, but rather to correct the secretions by alteratives, by the alkaline carbonates and salts, and by a spare, farinaceous, and milk diet. If, however, the intestinal irritation be severe, and the symptoms present a dysenteric character, ipecacuanha or Dover's powder, in frequent doses, may be exhibited, and emollient enemata administered; and, when restlessness and pain are complained of, these means, aided by warm baths, will be still more requisite.

24. When the menstrual discharge is suppressed or interrupted, these measures should be directed to its restoration; but these measures should be chosen according to the peculiarities of the case. In most cases of menstrual obstruction connected with cutaneous eruption, the iodide of potassium with liquor potassæ, and tonic infusions, will prove beneficial, if the bowels he duly regulated hy means of suitable aperients; and the biborate of soda, conjoined with any of the preparations of aloes, will often be of use in similar circumstances. M. Rayer has had recourse to the arseniate of soda in obstinate cases of pemphigus; and in these Donovan's solution of the iodide of arsenic and mercury may be employed with some hopes of advantage, as I have seen benefit derived from it in one case of this kind for which I lately prescribed it.

25. The observation made above respecting the pathological relations of pemphigus (§ 19, 21) should be borne in mind during the treatment of this eruption, and especially of the chronic states and complications of it; for a morbid condition of the circulating fluids, arising either from insufficient elimination or excretion, or from imperfect assimilation, as fully shown in the articles Blood and Disease, generally more or less obtains, not only in this, but also in most other cutaneous diseases. This position being unassailable, it should form the basis of our therapeutical operations and all our

efforts ought to be directed to the restoration of the excreting functions to the removal of all obstructions to the discharge of these functions, and especially of the cutaneous functions.

26. *C.* The *topical treatment* of chronic pemphigus is often of much importance. As a general principle, the serum effused in the bullæ should, as soon as they are fully developed, be let out by puncturing them, for even the partial absorption of it tends to perpetuate the morbid condition of the circulating fluids on which the complaint chiefly depends, while the early removal of the morbid secretion prevents not only this contingency, but also the excoriations and sores which often result from leaving the bullæ uninterfered with. After puncturing the bullæ, warm baths, warm bread and water poultices, or emollient fomentations may be employed, and, subsequently, gently astringent lotions, or absorbent powders, or healing ointments may be applied, according to the circumstances of the case.

[Dr. Bulkley thinks that, as a general rule, the bullæ should *not* be opened, and that warm and moist applications to them should be avoided. Should they burst, either spontaneously or by accident, some soothing application must be made to allay the irritation, and especially to protect the excoriated surface from the air.—*Am. ed. of Cazenave*, p. 118.]

27. *D.* The *dict* in this, as in many other cutaneous affections, should consist chiefly of milk and farinaceous articles; animal food, of easy digestion, should be taken sparingly; but veal, pork, shell-fish, and dried or highly-seasoned articles ought to be avoided. In cases requiring tonics, a more generous diet, and good wine in moderate quantity, may be allowed, particularly if due exercise in the open air be also taken.

Bibliog. and Refer.—*Delius*, Amœnitates Medicæ, cas. 9, p. 71.—*C. Lepois*, De Morbis a Serosa Colluvie et Diluvie ortis, Obs. 149.—*C. Seliger*, Ephemer. Nat. Curios., dec. 1, ann. viii., Obser. 56.—*Langhans*, in Acta Helvet., vol. ii., p. 260.—*Hoffmann*, De Affectu raro Scorbutico Pustulari, supp. ii., p. 2.—*Gilibert*, Adversar. Med. Pract. Lugd., 1773, p. 183.—*Dickson*, Observat. on Pemph. in Trans. of Irish Academy, 1787, p. 47.—*D. Stewart*, in Med. and Phys. Comment. by a Soc., &c. Edin., vol. vi., p. 79.—*Finke*, De Morbis Biliosis Anomalis, &c., p. 118.—*Macbride*, Method. Introduct. to Medicine, 4to. Dubl., 1772.—*J. P. Frank*, De Curandis Morbis Hominum, l. iii., p. 258.—*Wichmann*, Beyträge zur Kenntniss des Pemphigus, Erfurt, 1790.—*C. G. C. Braune*, Versuch ueber den Pemphigus und das Blasenfieber, 8vo. Leipz., 1793.—*L. Ritter von Brann*, Ueber die Erkenntniss und Behandlung der Pemphigus, 12mo. Erft., 1823.—*Ozanam*, Hist. des Malad. Epidemiques, t. v., p. 208.—*Lobstein*, Journ. Complément. des Sciences Médicales, t. vi.—*Robert*, Journ. de Méd. Chirurg. et Pharmac., t. xxiii., p. 227.—*Savary*, in Ibid., t. xxii., p. 203.—*Jacquemin*, in Journ. Génér. de Méd., t. xxx., p. 264.—*Martius*, Ueber den Blasenausschlag oder Pemphigus, 8vo. Berlin, 1829.—*Bateman*, Synopsis of Cut. Diseases, 1829, p. 197; and Delineations, &c., pl. 33, fig. 2.—*Hinze*, Sur le Pemphigus des Nouveau-nés; in Bullet. des Sc. Méd. de *Férussac*, t. xi., p. 47.—*Bidault de Villiars*, Recherches et Observat. sur le Pemphigus; in Recueil Period. de la Soc. de Méd. de Paris, t. liv., p. 1.—*Asdrubali*, Archives Génér. de Médecine, t. xvii., p. 601.—*Biett*, Journ. Hebdom. de Méd., t. viii. p. 46.—*P. Rayer*, Theoret. and Pract. Treatise on the Diseases of the Skin, trans. by *R. Willis*, 8vo. Lond., p. 208.—*Cazenave and Schedel*, Manual of Dis. of the Skin, trans. by *T. H. Burgess*, 8vo. London, 1842, p. 106.—*Erasmus Wilson*, A Pract. and Theoret. Treat. on the Diseases of the Skin, 8vo. Lond., 1842, p. 137.

[Am. Bibliog. and Refer.—Am. Ed. of *Cazenave*, *Plumbe*, and *Rayer*.—*Wilson* on Healthy Skin.—*Good's* Study of Medicine, by *Doane*.—*Worcester* on the Skin, &c.]

PERICARDIUM. *See art.* Heart and Pericardium.

PERIOSTEUM.—Περιοστεον—*Périoste*, Fr.—*Die Knockenhaut, Beinhaut*, Germ.—*The diseases of the periosteum* have been noticed in the articles Brain—*Membranes of*, Cranium, Fibrous Tissue, and Osseous System. When thus treating, in their respective relations, of certain portions of the periosteum, and when viewing them in connexion with the bones which they form and support, the several alterations of structure observed in the periosteum were fully noticed. It now only remains for me to consider *inflammations of the periosteum and their consequences.*

1. Inflammation of the Periosteum.—Synon.—*Inflammatio periostei, periosteitis, periostitis; Periostite*, Fr. *Die Entzündung der Beinhaut*, Germ.

Classif.—III. Class, I. Order (*Author*).

2. Defin.—*Pain, more or less acute, referred to the surface of one or more bones, with tenderness on pressure; deep-seated swelling, at first obscure, but afterward more manifest, sometimes with redness in the parts covering the more superficial and prominent bones; more or less symptomatic fever.*

3. The conventional division of periostitis into *acute* and *chronic* is useful, although every grade of activity and duration obtains in this as well as in other diseases. Periostitis is also *simple* and *primary*, or *consecutive* or *constitutional*. In this latter case it generally proceeds from previous disease, and is characterized by a certain diathesis, or is the consequence of a specific cause. Thus, periostitis may be *scrofulous, gouty, scorbutic*, or *rheumatic*, and present certain modifications in its course and consequences as it occurs in constitutions thus characterized. It may, moreover, be *specific*, or be caused by certain specific causes, as by syphilis and the excessive use of mercury. Due regard to these several states of the disease is requisite in practice, inasmuch as each of them requires a modified treatment.

4. i. Symptoms.—*A. Acute* and *sub-acute periostitis* often commences in an insidious manner, but it sometimes declares itself very acutely. In the former case there are generally neither chills nor rigours, and the accompanying fever may be slight; in the latter case, chills or rigours are often experienced, with intense pain, complete insomnia, and severe symptomatic fever. The progress of the disease in the one is generally slow, in the other much more rapid: it is often difficult to determine whether or not the inflammation is seated in the periosteum or in the bone itself. Most frequently, I believe the bone is affected nearly as soon as the periosteum, more especially in the scrofulous and syphilitic states of the disease. If the bone be superficial and the inflammation severe, swelling, at first hard or resisting, subsequently more superficially soft or doughy as it increases, may be detected in the course of the bone.

5. *a.* The symptoms are much more obscure where the periosteum of deep-seated bones is affected. In these cases, the attending swelling may be obscure or hardly felt, and the existence of the disease can be only inferred from the pain being fixed in or limited to some part of the skeleton, and from the nature of the predisposing and exciting causes. It is difficult to determine whether the disease commences

in the exterior or in the interior surface of the periosteum, unless under particular circumstances, as when the periostitis is caused by certain external injuries, by ulceration, or the extension of inflammation from parts covering the periosteum. In such cases, and when the inflammation extends from the periosteum to the soft parts covering or surrounding it, it may be inferred that the external surface of the periosteum is chiefly affected, and the bone underneath either slightly or not at all. And this condition may be also inferred where the disease attacks the *rheumatic* and *gouty diatheses*; and in these cases, particularly where the periosteum in the vicinity of joints is implicated, serum or fluid lymph often accumulates in the sheaths of tendons, or even within or around the capsules; similar changes, in these situations, have also been observed by me in several cases of *syphilitic periostitis*, complete recovery taking place without any indication of disease of the bones.

6. *b.* In the more *acute cases* of periostitis, *suppuration* is not an infrequent result. If the external surface of the periosteum be chiefly affected, the swelling becomes more and more manifest, softer, and circumscribed. The tissues external to the primary swelling become somewhat œdematous, or even reddened, and fluctuation, at first obscure, may be detected. In scrofulous constitutions, and when the periosteum of the long bones is affected, especially near articulations, œdema of the joints, or serous effusion under the capsules, or in the sheaths of tendons, is often observed; but these changes may also take place independently of suppuration, as in the rheumatic diathesis, but more frequently in connexion with it, in the scrofulous.

7. *c.* In the more acute cases of periostitis, when there is reason to infer the extension of inflammation to the bone itself, *suppuration* may likewise occur, and may detach the periosteum from the bone; but, in the more intense cases, and in cachetic or scorbutic habits, the morbid action in the periosteum may give rise to the effusion of a turbid serum between the periosteum and the bone, detaching the one from the other to a considerable extent, even before suppuration takes place, and to *gangrene* of the periosteum and *necrosis* of the bone. This result may take place in acute periostitis of any of the more superficial bones, and not infrequently in periostitis of the bones of the cranium and face; but suppuration is a more frequent occurrence. (*See articles* Cranium (§ 4), and Osseous System.—*Ostcitis.*)

8. *B. Chronic periostitis* usually commences slowly and insidiously, and presents similar constitutional and specific relations to those above alluded to (§ 3). It is more frequently observed than the acute, and is sometimes connected with ulceration, tumours, or other organic changes of the parts external to the periosteum; and is attended by slight pain only, which is often aggravated during the night by more or less tenderness, especially in superficial situations; and by varying or slight symptomatic fever and constitutional symptoms. Chronic inflammation, when limited to a very small extent of the periosteum, may produce various local changes, according to the grade of morbid action, and to the character of the secretion infiltrating the inflamed part and contiguous tissues; it may occasion simple thickening and induration, or even thickening with softening; it may give rise to the accumulation of a glairy, soft, or gelatinous or semifluid matter, chiefly external to the periosteum; or to a grayish, homogeneous matter resembling soft cheese; or to a fibrous, cartilaginous, or osseous substance. These even may form apparently between the periosteum and the bone, or in the fibrous structure of the former.

9. In the *rheumatic form* of chronic periostitis, thickening, or fibrous, cartilaginous, or even osseous transformation of parts of the periosteum sometimes takes place, particularly in the vicinity of articulations; occasioning stiffness, or even complete immobility of the joint or joints. In the *gouty state* of the disease, a calcareous or chalky deposite, similar to that which forms around the articular ligaments, and consisting chiefly of the urate of soda, sometimes takes place in the structure of the periosteum, or between it and the bone. In addition to these changes, various others are met with in the bones and in the periosteum, consecutively of chronic periostitis; but I must refer the reader to the notice taken of them in the articles mentioned above (§ 7).

10. The *terminations* and *consequences* of periostitis are in every respect the same as those shown to follow *osteitis*, and are attended by the same symptoms as accompany them. (See Osseous System, § 12–22.)

11. ii. Associations of Periostitis. — The periosteum is very rarely inflamed without an extension of the morbid action, in a greater or less degree, to the bone itself. Hence it is difficult to determine how far the bone is affected until the disease in it has made considerable progress. Much depends upon the diathesis and age of the patient, and the nature of the exciting causes; but when the pain referred to the bone whose periosteum is affected is increased, as in the case of any of the long bones, by sustaining a weight or standing on it, inflammation of the bone itself may be inferred. The association of osteitis with periostitis is most frequent in young persons, children, and the scrofulous diathesis; and the least so in the gouty and rheumatic.

12. When periostitis is seated in any of the vertebræ, or in the sacrum, or, indeed, in any of the bones either incasing parts of the nervous masses or furnishing outlets to the nerves, the consequent swelling of the periosteum and effusion of lymph may so affect the parts of the nervous system contiguous to it, or the nerves as they pass through their respective foramina or outlets, as to interrupt their functions, and to occasion *paralysis* more or less complete. I have seen several cases of paraplegia thus produced, and very recently attended one with Dr. Johnson and Mr. Liston where this complication existed. In these cases the bladder is often affected, indeed always when paraplegia is present. Periostitis may be also associated with *neuralgia*, and in this case the former is usually the cause of the latter, which not infrequently in these circumstances passes into palsy.

13. When periostitis affects the head, as the *pericranium*, of which I have seen two or three

cases, one of them that of a physician in this city, the symptoms are often distressing. The disease may be either acute or chronic, and proceed simply and favourably, as in the case just alluded to; but it also, owing to the extension of the inflammation to the inner table of the skull, or to the effect produced upon the nerves in the vicinity, may be complicated with *epilepsy*, as in a case recorded by Dr. Graves. Indeed, epilepsy is not infrequently caused by inflammatory and other changes in the dura mater; and we know that inflammation may be propagated from the pericranium, through the tables of the skull to this membrane, especially after injuries.

14. The complication of periostitis with gout or rheumatism need hardly be mentioned, since the latter are more commonly causes than complications of this malady; and this remark is still more applicable to syphilitic periostitis. Still they should be viewed also as complications requiring a modified and even peculiar mode of treatment.

15. iii. *The changes found in the periosteum* during the several periods of periostitis are briefly these: In the simple and early state of the disease, the membrane is red and injected, without any remarkable thickening or softening. The adjoining cellular tissue is also injected. At a somewhat more advanced period the injection increases and extends to the bone, the adhesion between which and the periosteum is now somewhat impaired. At a still later stage this membrane is redder, thicker, and somewhat softer, owing to some infiltration of lymph or serum; and it is much more easily detached from the bone; and the bone itself is often more discoloured. In the more chronic states of the disease, the membrane is less red, but it is more thickened, is more dense, and more closely adherent to the bone. In scrofulous persons, small abscesses or scrofulous suppuration may take place in the periosteum, and extend outwardly, with or without a more or less serious lesion of the bone.

16. When the disease goes on to suppuration, which may occur in either the acute, the sub-acute, or chronic state, particularly the latter in scrofulous persons, the periosteum is still more thickened, softened, villous at its surface, or even fungous. Suppuration most frequently occurs in the outer surface of the membrane, and proceeds externally; but sometimes it takes place from the internal surface, particularly when the bone is much affected. In this latter case it detaches the periosteum from the bone, causing considerable changes in both, often with perforation of the former, with extension of the abscess externally through the soft parts, and with the death of the bone underneath. In cases of injury of the pericranium, purulent matter is not infrequently collected between this part and the bone, and the inflammation having extended through both tables, advances to the dura mater, between which and the inner table matter often also collects, so that, before the abscess breaks externally, fatal lesions may be produced underneath the bone. In some cases abscess forms externally to the periosteum, and this membrane is thickened, opposing for a time a barrier between the abscess and the bone; but this is at last overcome, and the bone is more or less destroyed. In this case, periostitis and osteitis are consequent upon the inflammation of the adjoining parts. The other changes observed after periostitis are the same as those found after osteitis, and are described in the article on the Osseous System (§ 12–22).

17. iv. The Diagnosis of periostitis is generally easy when the periosteum of superficial bones is affected; hut in other circumstances it is extremely difficult. The history of the case, and the relation which the symptoms have with the causes which seem to have produced them, will generally aid in the formation of a correct opinion. When an acute or aching pain is felt in the situation of a bone, and is increased on firm pressure, and during the night; and more particularly when there is a fixed and deep-seated swelling which is continuous with the surface of the bone, it may safely he inferred that either periostitis or osteitis is present, or both; and, although it may be impossible to determine which of the two structures may be chiefly affected, the circumstance is the less important, inasmuch as the treatment is the same, or very nearly the same, for both. It is often much more important to ascertain the existence of certain of the consequences of the disease, particularly of *suppuration*, or of *caries*, or the death of the bone. When the former occurs, redness is often observed at the surface, unless the periosteum be deep-seated, and there is also some degree of œdema of the adjoining parts, followed hy more or iess distinct fluctuation, particularly when suppuration commences in the external surface of the periosteum. The existence of *caries* is to be inferred from what has been stated on the subject under the head Osseous System (§ 16–20).

18. v. The Causes of periostitis are altogether the same as those which produce osteitis. They are *constitutional* or *intrinsic*, or *external* or *extrinsic*.—*a.* Many of the former are chiefly *predisposing* causes, as the scrofulous, gouty, and rheumatic diathesis; but syphilis is not only a predisposing, but also an energetic *exciting* cause; and when it affects the scrofulous diathesis, not only periostitis, but osteitis also, often supervenes. Periostitis may also follow fevers, especially exanthematous fevers of a malignant character. It is not infrequently caused by scurvy, and by various chronic cutaneous affections, when neglected or allowed to proceed to ulceration, particularly in the extremities. All debilitating agents, unwholesome food, exhausting excesses, and the abuse of mercury, also predispose to periostitis.

19. *b.* The *exciting causes* are chiefly contusions and local injuries of all kinds; chronic ulcers near or over superficial bones; the irritation of abscesses, of tumours, or of tubercles in the vicinity of the periosteum; excessive muscular exertion, sprains, &c.; exposure to excessive cold or heat; and a prolonged or unsuitable exhibition of mercury, especially for syphilis affecting the scrofulous diathesis. Many of the cases of periostitis, osteitis, and consequent *caries* of the bones of the skull and face, which were formerly so frequent, and which are still occasionally met with, are more attributable to the excessive use of mercurials than to the disease for which they were prescribed.

20. vi. Treatment.—*A.* In the *acute* or *carly state* of this malady, the antiphlogistic treatment and regimen are requisite, particularly in young, robust, or plethoric persons. Even when we have cause of suspecting the periosteum only to be affected, the intimate connexion between it and the bone should induce us to employ decided and prompt means. *Local dcpletions* are always requisite, particularly in the simple form of the disease, occurring in a previously healthy person, and they ought to be large or repeated, or be preceded by general blood-letting, especially in robust or plethoric habits. After depletion, *calomel* should be freely exhibited with *antimonials* until the gums be affected, and I agree with Dr. Graves in thinking that the calomel is especially required when the pericranium and bones of the head are implicated; taking care, however, not to prescribe calomel so as to risk an injurious effect from it. When the periosteum of the more superficial bones is affected, as those of the head, face, or extremities, the practice of making *incisions* down to the inflamed structure, even before suppuration has commenced, and with the view of preventing this consequence of the inflammation, seems judicious, and is advocated by Crampton, Velpeau, Berard, and others. These incisions not only unload the vessels of the inflamed and adjoining tissues, but tend to determine the suppurative process, if this should occur, externally in the direction of the excisions, and thereby to protect the bone. When the inflamed periosteum is, however, deep-seated, such early incisions can hardly be practised, or only may be ventured on when suppuration has advanced. After local depletions, or even when they cannot be prescribed, as in those sub-acute attacks which sometimes occur in debilitated, exhausted, or broken-down constitutions, *blisters*, other *issues*, or the tartarized antimonial ointment, or other means which will produce vesication or irritation, with a *copious or prolonged discharge* from the cutaneous surface over the inflamed periosteum, will often prove extremely beneficial; but, as soon as vesication or a discharge is obtained, it should be favoured by warm poultices, and such other means as the peculiarities of the case will suggest, and perpetuated for a considerable period, so as to fully determine its effects. After these antiphlogistic means have been employed, the treatment about to be advised for the *chronic states*, if the disease still continues, should be employed.

21. *B.* In the *chronic states* of periostitis, the treatment should be nearly the same as that recommended for osteitis; for in this state the bone generally partakes more or less in the morbid action. Such, however, may not be the case to any extent in the *rheumatic* or *gouty states* of the disease, even when assuming more of an acute than of a chronic character; but, in the *scrofulous form* of the malady, the probable extension of the morbid action to the bones requires more especially the treatment advised for osteitis; namely, recourse to the *iodide of potassium*, with *liquor potassæ*, or Brandish's alkaline solution, in either of the preparations of *sarsaparilla*, or in bitter infusions. In the rheumatic and gouty states these means are equally beneficial; and occasionally the *mistura guaiaci* may be advantageously made the vehicle of the other medicines. In these states also, some one of the preparations of *colchicum* may be added to those just named; and a small quantity of *sulphur* with magnesia may be taken at bedtime for a considerable period, or until convalescence is far advanced.

22. C. If *suppuration*, either externally to the periosteum, or between it and the bone, should take place, an early exit ought to be given to the matter, and the local treatment proceeded with according to the circumstances of the case. The *iodide of potassium* and *liquor potassæ*, with *sarsa* and *tonics*, should, however, be persisted in, if no urgent reason exist to contra-indicate them; as they generally enable the system to repair whatever local mischief may have been done. In many of these cases, a full dose of some one of the preparations of *opium* will be conjoined with the above, or given at bedtime with benefit.

23. *D.* In the *other states of organic lesion* occurring in the periosteum, the means now mentioned are generally most efficacious, even when associated with *caries* of the bone. I state this from experience; but I should also add, that I have likewise seen the *bichloride of mercury* prescribed in the *compound tincture of bark*, with tincture of *capsicum*, almost equally beneficial with the iodide, both in the simple and in the advanced and complicated states of periostitis. In cases of *syphilitic periostitis* this salt, either in simple solution or prescribed with sarsa, is the chief remedy upon which we should confide, particularly if it he taken according to Van Swieten's method, and soon after a meal. In cases where mercury has not previously been given, or in those where it has been given in inadequate quantity or inefficient form, this mode of treating syphilitic periostitis should not be overlooked. Where, however, mercury has been resorted to in this complicated state of the disease, without marked benefit, the *preparations of iodine* should be preferred and sufficiently tried. As far back as 1824 I employed these preparations with decided success in both syphilitic and scrofulous periostitis; and about this period I prescribed them for a gentleman whose case presented this complication, and had become remarkable for the persistence and consequences of this disease, and the number of medical means and measures he had had recourse to. They proved efficacious in his case, as well as in others, and he is now alive and well. (*See* Osseous System, § 23–25.)

Bibliog. and Refer.—*Voigtel*, Handbuch der Patholog. Anatomie, b. i., p. 127.—*Gaudet*, in Journ. de Médicine, t. vi., p. 220.—*Wilson*, Lectures on the Struct. and Physiol. of the Parts composing the Skeleton, and on the Diseases of the Bones and Joints, 8vo. Lond., 1820.—*Rayer*, in Archives Génér. de Méd. Mars et Avril, 1823.—*A. Bérard*, in Dict. de Méd., art. *Perioste, Maladies*, &c.—*P. F. Blandin*, in Dict. de Méd. et Chirurg. Prat., art. *Periostite.*—*Cruveilhier*, Anatomie Pathologique, livrais. xxxv., pl. v. (*Extravasation of Blood between the Periosteum ond Bone.*)—*Parsons*, in New-England Med. Review and Journ.; and in Journ des Progrès des Sciences Méd., t. xv., p. 54.—*Roche et Sanson*, Nouv. Elemens de Pathologie, &c. Brux., 1834, p. 238.—*J. Hamilton*, Dublin Journ. of Med. Sciences, vol. ix., p. 255.—*R. Graves*, System of Clinical Medicine, 8vo. Dubl., 1843. See, also, Bibliog. and Refer. to articles Fibrous Tissue and Osseous System.)

PERIPNEUMONIA.—*See* Lungs—Inflammation of.

PERITONEUM—Diseases of.—The *peritoneum* (*περιτόνεον*, from *περιτείνω*, to extend around) was not recognised, until a comparatively recent period of medical history, as being often the seat of disease, independently of the parts which it envelops; and, as will be shown in the sequel, the most serious changes to which it is liable were, until modern times, often confounded with other maladies. The greater precision imparted to pathological research since the appearance of the writings of Morgagni, and more recently of those of C. Smith, Bichat, Baron, and others, and the more accurate connexion of lesions of this membrane with the phenomena or symptoms by which they are indicated, furnished by numerous modern writers, more especially by those referred to at the conclusion of this article, have combined to place our knowledge of the nature, symptoms, and treatment of diseases of the peritoneum greatly in advance of the progress it presented at the close of the last century, or even at the commencement of the present. In this article I shall, *first*, consider the several states of *inflammation of the peritoneum, and their consequences*; and, *secondly*, the *structural changes found* in this membrane independently of inflammation.

1. Inflammation of the Peritoneum. — Synon. *Peritonitis*, Vogel, Cullen, &c. *Phlegmone Peritonei*, *Phlegmone Mesenterii*, Prosper Alpinus. *Epiploitis*, Sagar, Sauvages. *Omentitis*, Vogel. *Inflammatio Omenti*, Boerhaave. *Mesenteritis*, *Enteritis Mesenterica*, Sauvages. *Inflammatio Mesenterii*, Hoffmann. *Febris Mesenterica*, Darwin. *Enteritis epiploitis*, Parr. *Cauma Peritonitis*, Young. *Empresma peritonitis*, Good. *Inflammatio Peritonei*; *Péritonite*, *Inflammation du péritoine*, Fr. *Darmfellentzündung*, *Bauchfellentzündung*, Germ.

Classif. — 1*st Class*, 2*d Order* (*Cullen*). 3*d Class*, 2*d Order* (*Good*). III. Class, I. Order (*Author*).

2. Defin. — Nosolog. Defin. *Tenderness, pain, heat, and tumefaction of the abdomen, with symptomatic fever; the patient always preserving a supine posture, with the knees drawn up; and the pain being aggravated by pressure, or by actions of the abdominal and respiratory muscles.*

3. Patholog. Defin.—*Increased vascularity, softening, or thickening of the peritoneal membrane, with effusion of coagulable lymph, or of a sero-albuminous, or sero-puriform, or sero-sanguineous fluid; sometimes with organized adhesions, &c.*

4. Inflammation of the peritoneum may affect persons of any age, of any temperament, and of any habit of body; it may attack suddenly and acutely, or slowly, insidiously, and chronically; it may be general or limited, or at first partial, and afterward more or less extended; and it may be primary or idiopathic, and consecutive or symptomatic. It may, moreover, be characterized by either of those states of vital diathesis which I endeavoured to establish as important pathological distinctions, when treating of *inflammation*, and which I ascribed to the nature of the exciting causes, and to the states of vital or constitutional power, and of the circulating fluids. Hence *peritonitis* may also be either *sthenic* or *asthenic* as regards the local action and the accompanying fever.

5. I. Acute Peritonitis. — *Acute peritonitis* in a *sthenic form* often *commences* in a part only of the peritoneum, but extends more or less to other portions of it. It is comparatively rare, in this state of the malady, that the peritoneal surface is at first extensively affected; but I have seen many cases of the puerperal and erysipelatous states of the disease, of the *asthenic form*, in which this membrane was more or less extensively implicated at an early period, and more particularly in the puerperal states of peritonitis associated with, or even arising from, *contamination of the circulating fluids*.

6. *True* or *primary peritonitis* commences in, and is chiefly confined to, the peritoneum; and, when thus originating, the inflammation more rarely extends to the organs which are enveloped by this membrane. As I have shown on several occasions, the inflammation does not so rapidly spread over the surface of the peritoneum as was generally supposed, unless in the asthenic forms of the disease, although the lymph thrown out from the surface of the part first affected rapidly irritates and inflames the opposite surface, or that coming in contact with it; so that it may be confidently asserted that sthenic acute peritonitis extends rapidly and chiefly by contiguity of situation, and but slowly and less remarkably by continuity of surface. I have often observed the opposite surfaces, or those in more immediate contact, intensely inflamed, while large portions of the surface continuously interposed between the inflamed parts were unaffected.

7. This limitation of the inflammation to opposite surfaces is equally remarkable when the *peritonitis is consecutive* of inflammation of a subjacent tissue or organ; unless, indeed, the circulating fluids have become contaminated and constitutional power much depressed, circumstances tending remarkably and rapidly to spread the morbid action continuously over the surface. In this latter case coagulable lymph is not formed, but a turbid and irritating serum is abundantly thrown out, as will be more fully noticed when I consider certain asthenic and complicated states of the disease.

8. i. Symptoms of Acute Sthenic Peritonitis. — The symptoms of acute peritonitis vary with the causes which produce it and with the portion of the membrane primarily and chiefly affected. As this form of the disease often originates in, and is limited to, a part only of the peritoneum, although often extending more or less rapidly and generally, I shall first describe the symptoms of the more *partial states* of peritonitis, and next those of *general* peritonitis.

9. *A.* Partial Peritonitis is most frequently observed after *surgical operations*, in connexion with incarcerated or strangulated *hernia*, and consecutively of inflammation of the *appendix cæci*, as shown in the article Cæcum, and of *metritis*, *ovaritis*, and *cystitis*. It is often, also, consequent upon, or associated with, *splenitis*, *hepatitis*, *enteritis*, and *dysentery*, and upon *chronic ulceration and perforation* of the *stomach* or of an *intestine*. Indeed, partial peritonitis is often consecutive of inflammation of parts enveloped by this membrane, the disease proceeding no farther, when occurring in a previously healthy state of the frame, than in the production of coagulable lymph, and the

affection and agglutination thereby of the opposite surface, terminating in adhesions which, as will be shown hereafter, time will modify or alter.

10. *a. Partial peritonitis*, consequent upon *local injury, surgical operations*, or occurring without any very obvious cause, *Peritonitis partiaria traumatica et spontanea*, generally commences with pain confined to a particular part of the abdomen; often with rigours or chills, but sometimes without either; with tenderness on pressure, and with slight fulness. To these soon succeed the usual attendants of symptomatic fever; increased or more constant pain and tenderness; a somewhat swollen, hard, and hot state of the most painful part; nausea, vomitings, and an anxious expression of the countenance, in the most severe cases. The bowels are confined, but stools are usually procured by active purgatives and enemata. The pulse is frequent, small, hard, or constricted. In some instances the complaint proceeds no farther, and either gradually subsides or is followed by indications of circumscribed effusion, or more rarely of purulent collection. In other cases the disease extends, and assumes, with greater or less rapidity, all the characters of general peritonitis (§ 19).

11. *b.* Peritonitis connected with *incarcerated or strangulated hernia — P. Hernialis — P. ex strangulatione*—presents similar features to the above, being only more intense and rapid in its course. The symptoms of partial peritonitis may exist, in cases of hernia, without any appearance of hernial tumours, and without the bowels being obstructed. In these cases, most probably only a small portion of one side of the bowel is strangulated, the canal not being thereby obstructed. A very interesting case of this kind occurred many years ago in a cook in my family, who had been subject to femoral hernia. She was removed to Guy's hospital, where she remained for a very considerable period under the care of Sir A. Cooper and Mr. Galloway, who agreed with the author in considering the case to be one of partial peritonitis from the strangulation of a small portion of one side of the sigmoid flexure of the colon. No tumour could be detected in the seat of the hernia. She ultimately recovered without an operation. Partial peritonitis, arising from internal strangulation, or even from the strangulation caused by the adhesions or bridles formed by an old partial peritonitis or omentitis, or from the operation of hernia or other local causes, presents the same symptoms as have been already noticed, and usually pursues a most unfavourable course, the inflammation extending with greater or less rapidity, with obstruction of the bowels and its consequences.

12. *c.* Inflammation not infrequently commences in that portion of the *peritoneum covering the appendix vermiformis and cæcum—Peritonitis partiaria cæci* — and is either more or less limited to it, or extended much farther. In most of these cases the disease arises, as I have shown in the article Cæcum, from inflammation of the appendix caused by the passage into it of hard substances, as the stones of fruit, gall-stones, &c. The symptoms are chiefly acute pain in the cæcal region, with distention, great tenderness, fulness or swelling, tormina, costiveness, nausea, and occasionally vomiting with symptomatic fever. The inflammation may continue limited to this portion of the peritoneum and the more immediate vicinity, terminating either in suppuration or in gangrene of the appendix, or it may extend much farther over the peritoneum, and ultimately become general. Several cases illustrative of these states and terminations of this form of partial peritonitis have come before me, and some of them are fully noticed in the article Cæcum.

13. *d. Inflammation of the peritoneum reflected over the abdominal muscles—Peritonitis superficiaria—P. antica—P. externa*—was first noticed by J. P. Frank, and afterward by Hildenbrand. They considered that this variety might be distinguished from inflammation of the visceral peritoneum. They remark, that it is attended by extreme tenderness of the abdomen, particularly at the umbilical region; by an extension of the inflammatory action to the cellular tissue connecting this membrane with the muscles; and often by the effusion of lymph into the sheaths of these muscles, causing extreme tension, hardness, and swelling. This variety usually commences with rigours, chills, and irregular heats, preceded and attended by a fixed acute and burning pain, remarkably increased by coughing, and by motions of the trunk. There are marked heat of the abdomen; swelling and hardness, particularly in the course of the recti muscles; occasionally distinct and circumscribed tumours; intolerance of the touch of the bedclothes, and of the slightest contractions of the abdominal muscles; and symptomatic inflammatory fever, with its usual attendants. The vomiting and obstinate costiveness accompanying some other states of peritonitis are not usually remarkable in this. These symptoms may, however, be present, and be attended by anxiety, nausea, and dyspnœa, as the inflammation becomes more extended, and by singultus, laboured respiration, &c., when it mounts to the diaphragm, as it usually does in the most severe and unfavourable cases.

14. *e.* If the inflammation be seated in the *peritoneum covering the psoæ and iliac muscles—Peritonitis psoitica—P. partiaria postica*—many of the symptoms already mentioned, with others which are proper to this seat, are complained of. Some of these occasionally resemble those attending hepatitis. Pain is felt in the back, sometimes obtuse, more frequently very acute. It is often referred to either flank, or to some part above the bladder on one side. An obtuse pain, occasionally with numbness, passes through the groin to the thigh, which the patient cannot stretch out without an increase of suffering. The urinary functions are not disturbed, and the bowels are not obstructed. There is more or less tenderness on pressure, according to the situation and severity of the inflammation.

15. *f. Dorsal Peritonitis* and *Mesenteritis—Peritonitis dorsualis — P. mesenterica* — are the most obscure of the several varieties of peritonitis; but it is very rare to observe inflammation of the peritoneum covering the dorsal and lumbar spine without the mesentery and intestines being more or less implicated.

When the disease originates in this situation, acute pain is felt along the spine, which is much increased upon extending or straightening the trunk, or upon drawing it upward or backward upon extending the limbs, and upon firm pressure of the abdomen. The febrile symptoms are most severe, with marked affection of the stomach and bowels. (*See article* Mesentery—*Inflammation of.*)

16. *g.* The *omentum* may be the principal seat of the inflammation—*Peritonitis omentalis*—*Epiploitis*—*Epiploïte*, Fr.—but it is extremely difficult to distinguish this state of the disease from that which is more or less extended. Indeed, general peritonitis commonly implicates the omentum; and this is more particularly the case in the asthenic and puerperal states of the disease. Or, if peritonitis commences in this situation, it rapidly extends, in the way already indicated, to all the parts coming in contact with the inflamed omentum. J. P. Frank states that, in true epiploitis, the epiploon is generally greatly thickened, and that he has seen it in several instances upward of an inch in thickness. Omentitis is usually attended by acute burning pain of the anterior part of the abdomen, above and below the umbilicus, but chiefly between the epigastrium and umbilicus, with extreme tenderness, a sense of tension, slight hardness, and marked swelling, and by acute symptomatic fever; but these symptoms are also present in most cases of general peritonitis, of which, however, omentitis is often a more or less considerable part.

17. Omentitis may be *associated* with inflammation of one or more of the contiguous viscera, as of the liver, stomach, colon, or small intestines, and by the symptoms more especially belonging to such complication. Indeed, simple omentitis rarely occurs, unless in connexion with some cases of hernia, it being usually associated with inflammation of contiguous portions of the peritoneum. It should also be recollected that the most severe cases only of omentitis present the acute symptoms just mentioned, and that slighter or *sub-acute* cases sometimes occur, in which the symptoms are milder, but more insidious and equivocal. I have even met with omentitis in a *chronic state*, and nearly limited to the omentum, with the exception of some adhesions to contiguous parts of the peritoneum, covering portions of the bowels and abdominal parietes. These cases have been generally in females somewhat advanced in life, and chiefly in those who have been subject to *umbilical hernia*. The *adhesions* consequent upon omentitis, and the extension of the inflammation to contiguous portions of the peritoneum, may become, even at a remote period after the recovery of the patient, the cause of internal strangulation of a portion of intestine. Many instances of this occurrence might be adduced, if it were necessary.

18. Omentitis, in a very acute form, often extending to contiguous parts of the peritoneum, is frequently observed in the course, or as a consequence, of *hernia*; and when the hernia consists of a portion of omentum and becomes strangulated, the inflammation thus induced often terminates in gangrene, which is either limited to a part of the omentum, or is extended to parts of the peritoneum and intestines. Omentitis may likewise, in either an acute or sub-acute state, terminate in *suppuration*. In this case the matter may find its way, by perforation, into the bowels, or externally through the parietes of the abdomen. J. P. Frank states that he has met with instances of this kind, but they are very rare.

19. *B.* General Peritonitis. — The more general states of peritonitis, occurring in a person of good constitution, or in a sthenic form, usually commence with rigours or chills, more or less severe and prolonged, with acute pain, soreness, and tenderness in the abdomen, and aching in the back or limbs. The abdominal pain soon becomes the chief symptom, is sharp, burning, pungent, or cutting, and is attended by a sense of tension, or of heat and distressing distention. It is aggravated by pressure, by efforts to vomit, or to pass a stool, or to pass the urine, or even by the slightest movement in bed. The patient cannot endure the weight of the bed-clothes, or of a fomentation. He lies on his back, with his knees drawn upward, thereby favouring relaxation of the abdominal muscles, and removing a part of the pressure of the bed-clothes from the abdomen. In some cases the pain is less acute, or remits somewhat for a short time, and returns with much severity. In others it is felt chiefly on pressure, or upon any effort; and more acutely after intervals, or when flatus is passing through or distending portions of the intestines. The pain is usually most severe about the umbilicus, or between this place and the hypogastrium; but it continues most acute at the part where it commenced, even when it extends most rapidly over the abdomen, which is hot, distended, and flatulent.

20. As the disease advances and is extended, the pain is increased by respiration, which soon becomes short and superficial. There are also nausea, frequent retchings, and vomiting of the fluids taken, with mucous matters, and sometimes with bile, more or less thirst, and generally constipation. The tension of the abdomen is at first attended by a marked contraction of the abdominal muscles, under the hand of the physician, owing to the increased sensibility being attended by augmented susceptibility, and disposition of the muscles to contract energetically, when the sensibility is excited. Subsequently, or after a day or two, seldom later, but often after a few hours only, the feeling of tension is attended by much distention, which varies in amount, and in the rapidity of appearance, with the intensity, and the general diffusion of the inflammation. The circumstances proper to the patient, however, modify the distention considerably; it is greatest in females of a relaxed habit of body, and soon after parturition; and least in males of a spare habit of body, with strong or rigid muscles. In this state or form of peritonitis the abdominal distention is equal throughout; any irregularity which may be felt arising chiefly from muscular contractions under the hand of the examiner.

21. *Percussion* can hardly be endured; but at an early period, the clear sound which is emitted evinces that the distention is owing to the accumulation of flatus; but this sound becomes more dull as the disease advances, particularly in more depending parts of the abdo-

men, owing to the collection of serum, while it still continues clear, or even more so, around or above the umbilicus. The ear or stethescope applied in different parts of the abdomen sometimes detect a rubbing or friction-sound, similar to that often heard in pericarditis or pleuritis; and this sound is caused by the motions of the opposite inflamed surfaces during respiration.

22. The countenance is pale, expressive of anxiety and suffering, and the features are sharpened and sunk. The patient continues motionless on his back, the least inclination to either side increasing his suffering; and he is afraid of quenching his thirst, lest vomiting should ensue and augment his distress. Respiration becomes more short, frequent, interrupted, and shallow, the action of the diaphragm increasing the pain. The pulse is frequent, small, constricted, or hard. The skin is hot and dry; the urine scanty, high-coloured, and often turbid.

23. The *course* of general sthenic peritonitis is usually rapid, and characterized by a progressive aggravation of the symptoms; especially of the tenderness, tension, and swelling of the abdomen; and of the sickness and vomitings. The pain and tenderness become more general, and diffused through the abdomen, extending to the back and loins; the face paler and more sunk; the anxiety and distress greater; and the pulse and respiration smaller and quicker. Having reached its acmé, the disease may continue for one, two, or three days, or even longer, nearly stationary, but with irregular exacerbations and remissions. Having, however, become general, and thus far advanced, it most frequently is not the less fatal, even when prolonged, as it sometimes is, to seven or eight days. General peritonitis, however, often runs its course in a much shorter period; in three or four days, or even in less time; but this rapid termination occurs most frequently in the *asthenic* and *puerperal* states of the malady.

24. II. Acute peritonitis presents certain varieties or modifications requiring particular notice. The most remarkable of these occur in the *puerperal states—Puerperal Peritonitis*—but as they present so many peculiarities, and are so often complicated with other affections connected with these states, I shall treat of the puerperal forms of peritonitis in connexion with those maladies with which they are so often associated, under the general head of Puerperal Diseases.

25. Some authors have noticed what they have denominated *bilious* and *nervous forms* of peritonitis; but these require merely a passing notice. The *former* of these is merely peritonitis occurring in connexion with an accumulation of bile in the biliary organs, and its discharge, chiefly by vomiting, during the course of the disease. The *latter* is characterized by a more than usual predominance of nervous symptoms; of acute pain, of low delirium or of convulsions, of restlessness, and, lastly, of coma, with subsultus of the tendons. It is obvious that these modifications are dependant upon previous disorder and temperament, and may appear in either the sthenic or asthenic forms of the malady.

26. i. Asthenic general Peritonitis — *Erythematic or Erysipelatous peritonitis* — most frequently occurs in the puerperal states, and will receive due attention in connexion with these states.—*a.* But it sometimes occurs independently of these, in debilitated and broken-down constitutions; in cachectic habits; in connexion with erysipelas, or with morbid states of the circulating fluids; in the course of exanthematous, adynamic, or other fevers; after spontaneous perforation of the stomach or intestines, or even of any portion of the peritoneum; and after the operation of *paracentesis abdominis*. Under these diverse circumstances asthenic peritonitis presents varied phenomena, as respects both the local and the constitutional symptoms. Still it exhibits many, and these the most characteristic, that are common to all circumstances; and chiefly the appearance of symptoms diagnostic of it after previous disorder, or during a state of ill health; its often sudden accession and rapid progress, and frequently without previous or concomitant rigours or chills; the greater softness, rapidity, smallness, and weakness of the pulse; the cachectic or even livid hue of the countenance and general surface, as when it occurs in the progress of fever; the almost sudden distention of the abdomen, and indication of serous effusion into the peritoneal cavity; the more profound prostration; and the rapid supervention of singultus, with frequent regurgitation of the contents of the stomach, coldness and dampness of the extremities, and other fatal symptoms.

[This form of peritonitis is a very frequent disease in those places where epidemic erysipelas prevails, and is extremely fatal. We have met with several cases of it, some of which ran their course with great rapidity, and one resulted in death in 48 hours. It generally comes on with great gastric disturbance and vomiting, tenderness at the epigastrium, extreme prostration, coldness of the surface, small and frequent pulse, &c. It is most apt to attack females who have recently been lying-in; but it is not confined to them: in some instances, although comparatively rare, it seizes upon males. For a more particular account of this affection, see *article* Epidemic Erysipelas.]

27. *b.* When the peritonitis results from *spontaneous perforation* of any portion of the *digestive canal* (see Digestive Canal, § 42), or from perforation of this membrane covering any of the abdominal viscera, by tubercular softening, disease, or rupture of vessels, or other lesions affecting the organs over which it is reflected, it is usually excited by the escape of fæcal, morbid, or other matters into the peritoneal cavity; and, although these matters may not extend much beyond the place through which they passed, yet they excite a spreading or asthenic inflammation, attended by a copious, turbid, serous, or sero-albuminous effusion, the constitutional powers being incapable of forming coagulable lymph, or such as can agglutinate the opposing surfaces, and thereby limit the extension of the inflammation or prevent the diffusion of the matters passed through the perforation over the peritoneum. In all these cases, the pain and tenderness are first referred to the seat of perforation, which is most frequently in or near the

right iliac region; but they rapidly extend, and are followed by all the symptoms just mentioned, which always terminate fatally, sometimes within twenty-four hours, and seldom later than two or three days.

28. *c.* Peritonitis from *paracentesis abdominis* usually presents similar characters, and pursues the same course as that just noticed. It is one of the most frequent varieties of asthenic peritonitis, and is almost uniformly fatal. It is very closely allied in its symptoms and progress to that state of the disease which has been denominated *crysipelatous peritonitis* by some pathologists, from the connexion sometimes subsisting between erysipelas and asthenic peritonitis. Indeed, the connexion is sometimes obvious, as when erysipelas attacks the parts punctured in paracentesis, as it sometimes does, particularly when it is prevalent in a hospital, or is epidemic in the locality. In rare cases, also, asthenic peritonitis occurs on the subsidence of erysipelas from external parts of the body. I have met with an instance of it consequent upon the disappearance of erysipelas from one of the lower extremities, and Dr. Abercrombie mentions another. In these, the patients complained of acute pain through the abdomen, with tenderness on pressure, great anxiety, and restlessness, death taking place within thirty-six hours. On *dissection*, the appearances were nearly the same in both instances; the intestines were all distended by flatus; the peritoneal surface was of a dark red, passing to a dull leaden colour, and the cavity contained much turbid serum, somewhat reddened, or of a sanious hue.

29. ii. *Hæmorrhagic peritonitis* has been noticed by Broussais and others, but it is extremely rare. It is not, however, to peritonitis consequent upon rupture of a blood-vessel, or of a viscus, as of the spleen or liver, that this term has been applied; but to asthenic peritonitis occurring in the hæmorrhagic diathesis, and attended by an exudation of blood from the capillaries of the peritoneum, without rupture. I have never met with a case of this form of peritonitis; but Broussais states that the symptoms are inflammatory at the commencement, and rapidly pass into those indicating great depression of the powers of life; the pulse soon becoming rapid, small, and soft, and death quickly supervening, with convulsions, cold and damp extremities and surface, and the other symptoms attending the fatal sinking of the asthenic and other states of the malady. The effused blood remains fluid, is mixed with serum, and the peritoneum appears generally affected.

30. iii. *Latent peritonitis* occurs sufficiently often to deserve notice at this place, although less frequently than is supposed by some writers. Indeed, it is very rarely that the disease remains latent when it occurs primarily, and perhaps never when it affects a robust or previously healthy person. It is chiefly when peritonitis attacks persons who are exhausted, cachectic, or otherwise diseased, or who are labouring under some other malady which attracts the chief attention, or who are maniacally or otherwise insane, that the characteristic symptoms are either imperfectly developed or overlooked from their slight or mild form, and from the more prominent affection of a distant part. It is chiefly from the absence of pain, tenderness, and pyrexia, and from the insidious progress of the disease, that the nature of it is unsuspected. The appearance and expression of the features; an attentive examination of the abdomen by pressure, percussion, &c.; and the position of the patient in bed, will generally disclose, without much doubt, the nature of the malady.

31. iv. The Terminations *of acute general peritonitis* are much influenced by the predisposing and the exciting causes; by the state of the patient at the time of attack; by the particular form the disease may assume; and by the several circumstances and influences to which the patient has been or is subjected.—*a. Resolution* of the inflammatory action sometimes occurs, and chiefly when the disease is of the sthenic form, is of a mild character, or less intense than that described above (§ 19); or, although equally severe with it, if the symptoms become ameliorated by treatment. A diminution of pain, tension, and tenderness; less frequent retchings; an improved state of the pulse and of respiration, and a more natural expression of countenance, are favourable indications, especially if they are accompanied by perspiration, a more copious secretion of urine, and freer alvine evacuations.

32. *b.* In many instances of resolution of sthenic peritonitis, evidence of *adhesions* having formed between parts of the contiguous surfaces is furnished in the continued tenderness or pain, increased by pressure, or accidental shocks, or quick motion, or by turning in bed, that is felt in one or even more parts of the abdomen, although the patient may apparently have nearly, or even altogether, recovered. That these symptoms result from adhesion has been proved by the subsequent history of some cases of this kind; these adhesions becoming the cause of internal strangulation of a portion of intestine, of partial peritonitis, and of the patient's death. In other instances the inflammation, instead of being completely resolved, is only abated, the symptoms gradually subsiding in severity, without recovery taking place. In these the acute passes into the *chronic disease* (§ 36).

33. *c. Effusion* of serum, or of sero-albuminous, or even of sero-sanguineous or sero-puriform matter, more rarely the latter, into the peritoneal cavity, is rather a consequence than termination of the disease. At an early stage the *effusion* is slight, but at an advanced period, and as the powers sink, it becomes more and more copious. The abdominal pain and tension then subside or altogether cease; the abdomen being soft, relaxed, but tumid, and dull on percussion, excepting at its most elevated part, where the sound emitted indicates flatulent distention of the intestines. Fluctuation is sometimes remarked, but occasionally it is obscure, or not evident, owing to the effusion being either traversed by adhesions, or existing between the folds of the mesentery and convolutions of the intestines, or gravitating to the iliac and pelvic regions.

34. *d. Gangrene* very rarely occurs in general peritonitis, even when it is most asthenic in its nature. It appears chiefly when the disease commences partially, as in the appendix

of the cæcum, or from strangulation or local injury. Its occurrence is indicated by sudden cessation of the pain and tension of the abdomen; by hiccough, and by coldness and clamminess of the extremities and general surface; by rapid, weak, small, thready, and intermittent pulse; and sunk, dark, and Hippocratic countenance.

35. *e. A fatal issue* may be the consequence of effusion and its effect upon the system, in connexion with the extent of lesion, and, in rare cases, of incipient gangrene. But it most probably chiefly results from the shock or influence produced upon the vitality of the frame by the great extent of the inflammation and consequent lesions; and this is especially the case when the disease is intense, and the peritoneal surface extensively affected at its commencement, for in these cases the powers of life most rapidly sink, especially when the malady presents an asthenic character. Where effusion is not extensive, and consists chiefly of serum, or of a sero-albuminous fluid, it does not necessarily occasion death, the patient sometimes recovering; the fluid being absorbed, and partial adhesions still remaining, or the disease passing into the *chronic form.*

36. A fatal issue occurs chiefly when the more intense cases of the sthenic form of the disease have been neglected at their commencement, and the more unfavourable consequences of inflammation have supervened before the treatment has commenced. In these, this issue usually takes place at periods varying from two or three to eight or nine days. In the several varieties of asthenic peritonitis noticed above, this issue generally occurs, unless in a few instances, where the disease is judiciously treated at its commencement, in from one to two or three days. This *termination* is preceded and indicated by increased alteration of the countenance; by greater rapidity, weakness, and smallness, or irregularity of the pulse; by coldness and dampness of the extremities; and by more frequent vomitings, the contents of the stomach being rejected without retchings or effort, and by mere regurgitation. On the accession of these unfavourable symptoms, the state of the respiration and the occurrence of singultus indicate the extension of the disease to the diaphragmatic peritoneum. The patient is now sometimes restless or oppressed, and the breathing is laboured or thoracic; but he still lies on the back, and makes no effort to move, even when fluids are regurgitated from the stomach, these being thrown over his person and the bedclothes. The matters thus ejected are fluid, with some mucus and green bile. He soon afterward either sinks into a state of coma, quickly terminating in dissolution, or he is attacked by convulsive movements, with difficult or laboured respiration, spasms of the diaphragm, and asphyxia, or he sinks with all the indications of vital exhaustion.

37. III. Chronic Peritonitis.—This form of the disease was not duly recognised and investigated until the commencement of the present century. Bichat was the first who distinctly and correctly noticed it, and Dr. Pemberton subsequently described one of its forms. Soon afterwards Dr. Baron fully illustrated the tubercular variety of chronic peritonitis; and about the same time Broussais, Montfalcon, Gasc, and the author, further investigated the disease. Although overlooked as an idiopathic and distinct malady by writers of the seventeenth and eighteenth centuries, still cases illustrative of its nature are to be found in the works of many of them, as shown in a memoir published by me many years ago, containing the history of some cases of it which had occurred in my practice. The writings of Columbus, Fantonius, Fernelius, Ballonius, Tulpius, Lomius, Bonetus, Tissot, Hoffmann, Burserius, and Morgagni, at the places mentioned in the *Bibliography*, furnish some interesting cases and remarks, illustrating the history of chronic peritonitis, and showing how frequently this malady was confounded with colic and mesenteric disease.

38. i. The History *of our pathological knowledge of chronic peritonitis* must nevertheless be considered as very limited. Although the medical writers of the last two centuries furnish no accurate description of this highly dangerous disease, yet their writings are not altogether deficient in proofs of a partial acquaintance with its nature; but they failed in recognising the lesions found on dissection of fatal cases as the results of chronic inflammation. Columbus (*De Re Anat.*, lib. xv.) describes "Conglomerationem intestinorum, natam videlicet ex ultimis ilei partibus una complicatis, tumoremque in hypogastrio exhibentibus." And Morgagni adduces several cases (*Epist. Anatom. Med.*, 39, sect. 24–32) in which he found the intestines agglutinated in one mass, and their coats possessed of an almost cartilaginous firmness. One of these cases occurred after ascites, and sufficiently marks the acute nature of the dropsical affection. Tulpius (*Observationes*, lib. iv., p. 348) mentions a similar instance in a female who had been affected from an early age with ascites: upon dissection, the peritoneal coverings were everywhere thickened to such a degree as to equal that of the ring finger.

39. Morgagni, when adducing the cases just referred to, mentions others from preceding writers, which are, as well as those seen by himself, illustrations of chronic peritonitis occurring without tubercular formations. He describes these cases as unfavourable results of prolonged or repeated attacks of colic and of ascites; and he describes others as forming varieties of abdominal tumours, owing to the thickening and induration of the peritoneal coat, and the agglutination of the intestines to each other and to one or more of the other abdominal viscera.

40. It is singular, however, that Morgagni, with all his pathological knowledge, did not attribute the changes in the peritoneum, which he has so fully and even frequently described, and with which he occupies nearly the whole of his thirty-ninth epistle, to inflammation. He is very much puzzled to account for the changes, now universally ascribed to chronic inflammatory action, and enters upon a somewhat lengthy disquisition (sect. 31) in explanation of it. He ascribes the pain to flatulent distention of the bowels; and the agglutination of the opposite surfaces to the pain and distention, which he considers to have caused

an exudation of a glutinous matter from these surfaces. The thickened and indurated state of the peritoneum, often found in connexion with more or less serous effusion, he imputes to the effect produced upon this membrane by its prolonged maceration in an acrid or morbid serum. When adverting to the symptoms, he remarks, "Pulsus humilis et debilis potius, et qui, si bene attendas, sibi obscure, dissimilis sit: abdomen autem tensum, et durum, et cum dolore quodam; facies denique insoliti aliquid, sed in aliis aliud, ostendens," &c.

41. Hoffmann, after describing the more acute affections of the intestinal tube which terminate either fatally or in health, in a very short time, mentions those of a chronic character, which he denominates "dolores chronici, vel colicæ diuturnæ." He describes them as continuing during many weeks, and even for the space of a twelvemonth, with various intermissions and exacerbations. On dissection, "the intestines are found constricted, their coats thickened, callous, and scirrhous," &c. (*De Intestinorum Doloribus*, sect. ii., cap. v., p. 180.)

42. Other instances could be also adduced, from Bonetus (sect. xxi., *Observat.* 3–8), from Fantonius (*Observationes*, *Epist.* 4), and from the Acta Academ. Nat. Cur. (tom. i., Observat. 87; et tom. vi., Observat. 124), in all of which the intestines, omentum, and mesentery were accreted into one mass. Burserius mentions similar cases, which he considered as arising from an "arthritica, rheumatica, herpetica, scorbutica, vel scabiosa materies, retropulsa." Speaking of these diseases, which he denominates "intestinorum conglomerationes," he remarks, "Similem (conglomerationem) vidi in muliere colica chronica jamdiu afflicta, et demum marasmo confecta." (*Institutiones Medicinæ*, vol. iv., p. 362, *et seq.*)

43. Jodocus Lomius furnishes some remarks which may be referred to this disease. "I find it observed," he says, "by some learned men that the peritoneum, or at least those membranes which cover the abdomen and parts of the belly, are likewise afflicted with very grievous pains. These pains, although they in nowise belong to the colic, yet they are equally violent. And these, as they are very severe, so likewise are they very long, and yield to none of those remedies which are proper in the colic, whether medicines, fomentations, and clysters; but generally succeed long fevers, and those kinds of bilious diseases which are not easily solved, and have been often observed to terminate, as it were critically, continued fevers, as well as tertians and quartans. The mesentery may also be seized with an inflammation; at this time there is an inward weight, but no manifest pain; a fever arises, but this is moderate," &c. (*Observat.*, p. 316, *et seq.*)

44. It is not, however, to the scanty details furnished by the earlier writers in modern medicine that we are to attribute the progress made in our knowledge of the pathology of chronic peritonitis; but to the researches of Bichat, Pemberton, Baron, Broussais, Montfalcon, Gendrin, Gasc, Scouttettin, and Hodgkin, that we are chiefly indebted. Up to the time of the earliest of those writers, this disease was confounded, as I have now shown, with colic, mesenteric affections, or tumours of the omentum. And it is very probable that the varieties of colic, particularized by many of the older writers under the appellations arthritica, rheumatica, scorbutica, metastica, inflammatoria, symptomatica, diuturna, chronica, endemica, &c., were actually chronic inflammations of this membrane, the disease occurring in the manner indicated by those specific names. In addition to this catalogue of names, others from the same and different authors may be mentioned, as constituting varieties of colic, as colica herpetica, C. ex scabiosa materie retropulsa; C. ex perspiratione retenta, atque ad intestina translata; C. mesenterica, &c., which, most likely, were truly affections of a slow inflammatory nature, attacking this membrane, and either simple or primary, or associated with tubercles. Fernelius appears to have been of this opinion; he says: "Ab acri vero erodentique humore, aut etiam ab inflammatione, quisquis ortus fuerit, dolor colicus fixus etiam est, sed cum febricula, ardore, siti et vigiliis; irritatur esculentis potulentisque calidioribus, a quibus etiam sumpsit originem." And again, "Alii insuper cruciatus quadam similitudine et vehementia colici nuncupantur, quibus tamen non in colo intestino sedes est; sed vel in peritonæum vel in membranis quæ abdomini ventrisque partibus obtenduntur. Hi sane gravissimi sunt, et admodum diuturni, ac neque clysteribus, neque medicamentis, neque fomentis, neque iis remediis quibus qui vere sunt colici dolores, deliniri solet." (Fernel., *Pathol.*, lib. vi., c. vi., p. 159.) Although Willis did not consider colic to be an inflammatory disease, he believed the part primarily affected by it to be the mesentery, "which is highly sensible," he adds, "and through which a morbific matter is conveyed, not by means of the arteries, but by the nerves, and its seat is not the proper coats of the intestines." (*Pathol.*, p. 11, c. xv.) Many a case of chronic peritoneal inflammation probably is, even in the present day, taken for colic, but more especially for diseased mesenteric glands; the size of the abdomen, its irregular hardness, with the hectic, emaciated limbs, and dry, foul surface, being symptoms, which may readily be mistaken, if not carefully inquired into, for those of the latter affection. Indeed, disease of the mesenteric glands may be induced by continued irritation, existing primarily in the serous membrane; and, in the tubercular form of chronic peritonitis, I have shown that tubercular disease of these glands is often also present. It may be also granted that disease sometimes takes place in these glands coetaneously with morbid action in either of the mucous or serous membranes, in consequence of, and depending upon, the nervous influence supplying the capillary vessels distributed to those textures, and upon the state of the circulating fluids; chronic inflammation with tubercular productions resulting therefrom in scrofulous constitutions.

45. Chronic peritonitis not unusually supervenes on continued exanthematous and remittent fevers. I have met with several instances of this connexion. Tissot (in his dissertation *De Febribus Biliosis*, p. 143) mentions an affection following fever which continued for many months. He gives the following charac-

teristic symptoms: "Accessit diarrhœa sæpe recurrens, tumet frequenter tympaniticè abdomen, et fere semper dolet, ita ut minimam vestium constrictionem fere nequeat; deletur prorsus appetitus; urget sæpe sitis; parvus est somnus; urinæ paucæ, turbidæ." This case evidently puzzled Tissot; for he asks, "Quænam causa morbi?" He adds, "Tahes succedat, tympanitis, ascitis, icterus, mors." He makes no mention of any dissection. Chronic peritonitis may follow acute dysentery; and even during the continuance of the chronic form of that disease, from an extension of the inflammatory action to the serous membrane. I have met with several instances of this occurrence in the course of practice; and they are often seen in climates where dysentery is endemic; and many cases are recorded hy writers in the last century that illustrate this succession.

46. Although chronic peritonitis sometimes occurs as a secondary affection, and is complicated in the manner just alluded to, it appears also as a primary disease. This independence of inflammation of the peritoneum of disease of the contiguous structures did not escape the penetrating mind of John Hunter. "If the peritoneum," he says, "which lines the cavity of the abdomen, inflames, its inflammation does not affect the parietes of the ahdomen; or if the peritoneum covering any of the viscera is inflamed, it does not affect the viscera. Thus, the peritoneum shall be universally inflamed, as in the puerperal fever, yet the parietes of the abdomen, and the proper coats of the intestines, shall not be affected. On the other hand, if the parietes of the abdomen, or the proper coats of the intestines are inflamed, the peritoneum shall not be affected." (*On the Blood and Inflammation*, p. 244.) Bichat remarks: "L'affection d'un organe n'est point une conséquence nécessaire de celle de sa membrane séreuse, et reciproquement, souvent l'organe s'affecte sans que la membrane devienne maladc," &c. (*Anat. Générale*, vol. i., p. 551.) And Sprengel observes, "Neque facile ad reliquas intestinorum tunicas transit adfectus hujus externi velamenti, unde peritonæi inflammationes sæpius observamus sine ullâ inflammatione tunicarum musculosarum et nervearum." (*Institut. Physiol.*, t. i., p. 343.)

47. ii. Description.—*Chronic peritonitis* appears in *two distinct forms:* 1st. It occurs *primarily*, and then generally gradually and insidiously, and most frequently in connexion with tubercular formations; 2d. It appears *consecutively*, or succeeds to the acute form of the disease, or to inflammation of some viscus that has extended to the peritoneal covering. As in the acute form, so in this, the inflammation may be either *partial* or *general*. It is most frequently the former when it proceeds from local injury, or from inflammation of a subjacent viscus, and it is often general when it is granular or tubercular, or is associated with serous or dropsical effusion; but the general, as well as the partial state of the malady, may be consequent upon some other disease, particularly dysentery, enteritis, hepatitis, inflammation of the uterus and its appendages, &c. Dr. Baron and M. Louis concluded that chronic peritonitis, occurring primarily, is always associated with tubercles. As early as 1821, I combated this opinion, and adduced two cases which were exceptions to the law which these pathologists believed to exist. More recently, Dr. Hodgkin has stated that the form of peritonitis which is accompanied with copious effusion, occurs without any tubercles; and the same may be said of other cases, in which the concrete product of inflammation had been more considerable. However, it must be admitted that chronic peritonitis appearing independently of injury, of rheumatism, of visceral disease, or of cutaneous eruptions, is generally tubercular, and is observed chiefly in scrofulous constitutions; and that when it is consecutive of these maladies, or appears from the suppression of external affections, it is rarely associated with tubercular formations.

48. *A. The symptoms* vary at the commencement of chronic peritonitis, with the exact nature, seat, and associations of the disease.—*a.* When it is *tubercular*, it is always insidious, slow, and often latent, until it is considerably advanced; and soon after it is recognised, it often rapidly terminates fatally. At first there is often very little pain, and in some cases none at all. In others, griping or colicky pains are occasionally felt, and frequently after long intervals. A sense of broiling or burning heat is complained of in the epigastric and umbilical regions. The bowels are irregular, more frequently relaxed than confined, the excretions being offensive, deficient in bile, and otherwise morbid. Nausea is often complained of, but vomiting is not frequent unless at an advanced stage of the disease. The matters thrown up are fluid, with mucus and a little green bile, and are more or less acid. The urine is scanty, high-coloured, and deposits a reddish sediment. The tongue is usually red, glazed, and chapped, its surface being often slightly fissured and uneven. The surface of the body is foul, lurid, and dry, but perspires freely during the night. The pulse is quick, small, and weak. The body is always more or less emaciated; the countenance and eyes are sunk; and the extremities cold, attenuated, and slightly livid or dark. A livid or dark circle surrounds the eyes, and the face and whole body appear as if faded or blighted.

49. The *abdomen* is always large or tumid relatively to the rest of the body, particularly at an advanced period of the malady. If the peritoneal cavity contains any fluid secretion, slight or obscure fluctuation will be detected, and there will be dulness on percussion, particularly in more depending situations. When pressing or kneading the abdomen, a doughy state is remarked; and the inclosed viscera and the abdominal parietes feel as if they constituted one mass. Tenderness is often not considerable, but it varies and is more remarkable in one part than in others, and the seat of it varies in different cases, and even in the same patient at different periods. The abdomen often presents irregularities, which are sometimes mistaken for enlarged mesenteric glands. These irregularities are generally owing to the development of larger tubercular masses accreting the intestines, and occasionally by scybalæ in the cells of the colon. These masses of tubercular accretion are often more manifest on examination, when a fluid effusion has been removed by absorption.

50. Tubercular peritonitis is often insidious

and slow in its early stages, and may thus be almost *latent* until shortly before death. In these cases, however, there have been generally an irregular state of the bowels, sometimes nausea, morbid evacuations, and more or less emaciation. But these have proceeded without creating alarm, as they were attended by little, or only occasional pain. At last the emaciation, the blighted appearance of the system, and the relaxed state of the bowels, attract attention; or acute symptoms are suddenly complained of, especially acute abdominal pain, increased disorder of the bowels, vomiting, and rapid sinking of the vital powers. As soon as these symptoms supervene, the disease proceeds with variable rapidity to a fatal issue.

51. In a few cases the abdomen seems more flat than usual, but is then always duller on percussion than natural. The surface of the belly is generally warm, dry, and of a livid or dark hue; and in many instances it is traversed by large blue, or distended veins, indicating impeded abdominal circulation. In addition to the inequalities just alluded to, the inguinal glands are generally enlarged, and painful on pressure. The diarrhœa, which was at first slight, occasional, and interrupted at times, or even alternated with slight costiveness, becomes more continued, and less under the control of treatment, for it then, as will appear in the sequel, is the result of ulceration. The stools are always unnatural, and contain undigested matters. Life is soon afterward terminated by gradual exhaustion of its powers.

52. *b.* When chronic peritonitis is *consecutive* of the acute state, or when it appears from the metastasis of disease, or after visceral inflammations, or after suppressed eruptions, or when it is non-tubercular, although *primary*, it usually presents somewhat different phenomena. In these circumstances, the abdomen is the seat of a deep-seated but not very acute pain, which often intermits, and is either increased, or not much complained of unless upon pressure, or when the abdominal muscles are contracted, or when the trunk experiences a shock, as when taking a false step. Nausea and even vomiting are occasionally experienced, and digestion is always difficult, food oppressing the stomach, and producing pains in the abdomen as it passes through the intestines. In some cases, these pains are felt in a particular part, in others their seats vary. Constipation is often present at an early stage; it is subsequently alternated with diarrhœa; hut, at an advanced stage, the bowels are much relaxed, and the stools morbid, sometimes containing undigested substances. Emaciation is considerable, and always greater as the disease advances. The countenance is sunk, anxious, pale, and sallow. The skin is dry and unhealthy in appearance, the respiration is laboured, short, or quick, and the pulse is frequent, particularly towards evening and night. When the chronic disease follows the acute, the severe symptoms of the latter gradually subside and lapse into those attending the former, varying, however, with the exciting causes, and the circumstances developing the primary attack.

53. The state of the abdomen varies with the presence or absence of fluid effusion in the peritoneal cavity. When fluid is present, the abdomen is enlarged, often so as to contrast remarkably with the emaciated limbs, and it is tense, distended, dull on percussion, unless at the more elevated parts. Fluctuation is seldom very manifest, more frequently it is obscure. Occasionally œdema of the lower extremities, and of the more depending parts of the abdominal parietes, is remarked. When there is no fluid in the cavity, the abdomen often appears diminished rather than increased in size. In some it is quite flat, in others it presents a slight or an irregular swelling about the umbilicus, owing to the agglutination of the small intestines. It is generally somewhat dull on percussion, but not more so in the more depending situations. On careful palpation of the abdomen, the experienced examiner will readily feel that the suppleness of health is wanting, and is replaced by an internal resistance or tension, indicating the adhesion of internal parts, while the integuments are loose, and move readily over the more tense parts underneath.

54. *c.* Chronic peritonitis may be *partial* or *general*. The former occurs chiefly after inflammation of some abdominal viscus that has extended to the peritoneal surface. In this case, the lymph thrown out upon that portion of this surface excites inflammation in a part opposite to, or coming in contact with, that first affected, and thus adhesions, or thickening of the opposite parts, or both, may be produced, and the disease proceed no farther, the patient dying at some subsequent period of some complication of this state of partial peritonitis, or of some disease developed at a more or less remote period.

55. *Partial chronic peritonitis* is sometimes observed after enteritis, after inflammation of the colon and dysentery, after chronic ulceration and perforation of the stomach or intestines, after hepatitis, and after inflammations of the urinary and sexual organs. When these maladies induce peritonitis in persons not remarkably debilitated, or otherwise of good constitutions and habits of body, the disease may not only proceed no farther, but it may be so limited, or so latent, as not to give rise to distinctive phenomena indicating its existence, although slight uneasiness and pains, increased on sudden motions, jerks, or muscular actions affecting the abdominal viscera, or on pressure in certain directions, are often present.

56. When, however, peritonitis supervenes upon any of the above maladies affecting scrofulous, cachetic, or broken-down constitutions; or in persons whose excreting organs are torpid or diseased, and whose circulating fluids are contaminated or insufficiently depurated, it usually spreads more or less, and becomes even *general*, and in these cases is attended by more or less of fluid effusion, unless in children, young persons, and the scrofulous diathesis, where it is more frequently accompanied with tubercular formations.

57. *d. The terminations or consequences* of chronic peritonitis are those organic lesions which will be particularly described in the sequel, and which, although most extensive, cannot be individually distinguished by symptoms, as they are variously associated or grouped in most cases, and when either far advanced in

their separate states, or associated, give rise to nearly the same phenomena, which are those characterizing the advanced stage of the malady.

58. IV. Peritonitis in Children.—Peritonitis may occur even in the *fœtus*, and hence may be *intra-uterine*, and even *congenital*; but it much more frequently appears after birth, particularly between the second and eleventh years of age, and is one of the most important diseases of childhood. It may be either *acute*, *sub-acute*, or *chronic*; and it may be *simple* and *primary*, *tubercular* and *consecutive* or *complicated*. It may also be *partial* and *general*: in other words, in either its acute or chronic states, it may be partial or general, and each of these may be primary and simple, or consecutive and complicated; and, farther, any of these states may exist either with or without tubercular formations, although the chronic form is comparatively rarely seen unassociated with tubercles. Moreover, instances have occurred of simple or non-tuberculated peritonitis having been developed in the course of tubercular disease in other organs, as when simple acute peritonitis proceeds from perforation of the intestines or stomach, occurring in the course of tubercular consumption, or of intestinal diseases, associated with tubercles in various organs.

59. *A. Acute and sub-acute peritonitis* is more frequently a *consecutive* than a *primary* disease in children. It rarely occurs primarily and simply in the previously healthy, but most frequently in the course of, or during convalescence from, fevers, particularly eruptive fevers; and especially of those cases which have presented predominant disorder of the abdominal organs or diarrhœa. It may even occur in the advanced progress of the chronic form, and prove fatal in a short time.

60. *a. Pain* is generally the earliest symptom, and is often at first local or limited, but it soon extends over the abdomen, is increased by pressure and motion, and continues to the termination of the malady. *Vomitings*, which are frequent in the peritonitis of adults, are much less so in that of children, and often do not occur until an advanced period. The *bowels* are seldom much confined, particularly as the disease advances. They are more generally relaxed, and the stools become more frequent and morbid as a fatal issue is approached. *Respiration* is accelerated, but short and shallow. The *tongue* is generally moist, and covered by a whitish or yellowish coating. The *appetite* is lost, and there is always great *thirst*. The *countenance* is expressive of pain, anxiety, and distress. It is pale, collapsed, or sunk. *Nervous symptoms* are rarely observed, unless in very young children, and in these convulsions are the chief form they assume. The *position* of the patient is always on the back, with the knees drawn up.

61 The *abdomen* becomes tumefied very soon after pain is first felt, is always tense, and then sonorous throughout upon percussion. When the peritonitis is *partial*, the swelling and tension are often confined to the situation affected, and this partial state of the disease is most frequently observed in the right flank, or in or near to the right iliac region. As the disease advances, the abdomen, particularly in the situation of any manifest tumours, becomes more dull than natural on percussion, but the tenderness often prevents this mode of examination from being practised. When the disease is general, flatulent distention increases and is more manifest. Fluid effusion is seldom clearly evinced by fluctuation. The surface of the abdomen is usually warmer than natural.

62. *c.* There is always more or less *symptomatic fever*, which is seldom ushered in by distinct rigours. The *pulse* is very quick, and commonly the quicker, smaller, and weaker, the more intense and the more general the disease. The urine is scanty and high-coloured, and voided frequently; the skin is hot, dry, harsh, and of a dull unhealthy appearance.

63. *d.* The *duration* of acute peritonitis varies from twenty-four hours to thirty-eight or forty days. When the disease proceeds from perforation of any part of the digestive canal, its duration is usually the shortest, as in adults. When it continues longer than thirteen or fourteen days, it is either partial, or presents a less severe or sub-acute character. When peritonitis *terminates* in *resolution*, the general or constitutional symptoms are ameliorated; the pain subsides or altogether ceases, and the abdomen gradually resumes its natural condition. The bowels become more regular, and the pulse slower and fuller. If much fluid effusion have attended the inflammation, the abdomen is longer in resuming its former state. If the disease continue to advance to a *fatal issue*, the swelling and tension of the abdomen increase, the countenance becomes more sunk, the bowels more relaxed, the pain more severe and more general, and the pulse more rapid, smaller, and at last inappreciable.

64. *e.* Acute peritonitis is rarely associated with *tubercles* in children, but the chronic form is very often thus complicated. It sometimes, however, supervenes in the course of tubercular formations in other or even distant organs, especially of ulceration of the intestines, in connexion with tubercular disease of the mesenteric glands, and of tubercular consumption, and it occasionally appears in the progress of the chronic disease, either simple or tubercular. In this latter case, acute symptoms are suddenly developed, the abdominal pains become more severe, the fever, the distention, and the heat of the abdomen are augmented, the pulse is more rapid and smaller, and the countenance is more anxious and sunk. The disorder of the bowels increases, and, with the progress of the organic lesions, soon terminates life.

65. *B. Chronic peritonitis* in children is generally associated with tubercular formations, and is often then more or less general. It may, however, occur without this association, especially when it is partial, and consecutive of inflammation of one or more of the abdominal viscera. It may also follow the acute form of the disease, either from the natural decline in the severity of the attack, or from the treatment resorted to.

66. *a. Simple or non-tuberculated chronic peritonitis* can rarely be distinguished from the tubercular during life, unless the history and circumstances of the case be duly considered. When it seems to follow inflammation of some viscus, or the acute disease, in children of a

previously healthy frame, and free from constitutional vice, then it may be presumed to exist independently of tubercles. As respects the symptoms, there appears hardly any difference between this variety and the tubercular, about to be noticed. In the former, however, distinct tumour, or inequalities in the abdomen, are more rarely or never observed; and there is often less dulness on percussion In other respects the phenomena and progress of both varieties are the same.

67. *b. Chronic tubercular peritonitis* in children is generally attended by *pain* from the commencement, often before the abdomen presents any swelling, although often also contemporaneously with swelling and tension. The pain is in some cases local, in others general or erratic, but it is not, when local or fixed, always an indication of the chief seat of tubercular productions. The *tongue* is moist, white, or coated with a yellowish matter at its base; less frequently red and glossy. The *appetite* is frequently but little, or even not at all, impaired; it is more generally irregular and capricious. It is sometimes not materially diminished throughout. *Thirst* is generally felt, and it increases with the progress and severity of the symptoms and associated affections. *Vomitings* rarely occur in this state of peritonitis, although they are not infrequent in the acute. *Diarrhœa* is commonly observed, and it increases as the disease advances, especially when ulceration of the intestines is present, and this is rarely wanting in the last stage.

68. The *abdomen* presents the most characteristic appearances. At an early period its form presents little or no change beyond being somewhat more full and sonorous on percussion. As the disease advances, but at no definite period, the belly becomes distended, and is either sonorous throughout, or is dull in some parts and sonorous in others. When the dulness is found always in the same situation, and is attended by some hardness or doughiness, suspicion of the existence of the disease is generally well-founded. In some cases an obscure fluctuation is felt in the more dull parts of the abdomen, owing to a partial fluid effusion attending the tubercular lesion of the peritoneum. With increased distention and tympanitic sound there is often more or less tension, which is sometimes greater in one side or part than in another, and when it is great the part is elastic rather than hard. As the disease advances, particularly in older children, the abdomen presents many of the changes already noticed. When the tension is very great the surface becomes smooth and shining, and afterward harsh or scurfy, owing to desquamation of the cuticle. The veins in the surface of the belly are then often large and distended.

69. *c.* The *progress* and *duration* of this form of peritonitis vary remarkably in different cases. The disease is often far advanced before it excites alarm, and is mistaken for simple disordered function of the bowels, and the pains for those of colic. The flatulent state of the digestive organs generally attending, as well as preceding, the complaint, is frequently considered as the source of all the disorder until serious organic lesions are developed, and then *emaciation, febrile exacerbations, diarrhœa*, partial or general *night perspirations*, and the symptoms just mentioned, disclose the nature of the malady. The *duration* of the disease can rarely be precisely determined, as the exact period of its commencement cannot often be ascertained. The patient has been frequently out of health for a considerable period before the symptoms were fully evolved, and it is most probable that the tubercular formations connected with the peritoneum commenced about the period of the earliest indication of impaired health. The continuance, therefore, of the malady may, according to my experience, vary from two or three to eight or nine months. Instances of a shorter or even longer duration may occur, but they can be very rare.

70. *d.* The *termination* of this form of peritonitis is always fatal. But this issue is not owing to the extent of the tubercular disease solely, but partly also to associated disease in other organs, to tubercular formations in other viscera, particularly in the lungs, in other serous membranes, in the mesenteric glands, to ulceration of the intestines, &c.

71. V. Complications of Peritonitis.—The several forms of peritonitis may be variously complicated. Peritonitis in the puerperal state, as will be shown in the article on Puerperal Diseases, is most frequently complicated with disease in other organs and parts; but those states of peritonitis already considered are often also complicated, although not so frequently and so extensively as those occurring after parturition. The *symptomatic fever* attending peritonitis can hardly be viewed as a complication, as it depends upon the previous health of the patient, the state of nervous or vital power, and the condition of the circulating fluids; depression of power and contamination or imperfect depuration of these fluids giving rise to an adynamic state of fever, and favouring the extension of the malady and fluid effusion. The *complications* of peritonitis are of two kinds: 1st, those in which the peritonitis is a consequence of the disease with which it is associated; and, 2d, those which consist of extensions of the peritonitic malady. The former are the most numerous, frequent, and important.

72. *A.* When peritonitis supervenes on other visceral disease, and is thereby associated with it, the inflammation may be *limited* to a portion of the peritoneum, or *extended* more or less generally, the limitation or extension depending upon the states of vital power, and of the circulating fluids, as already specified (§ 4).

73. *a.* The complication of *hepatitis* with peritonitis is generally with the *partial form* of the latter, the former being the primary malady. In this association, as will appear by referring to Liver—*Inflammation of*, the diaphragmatic, or the parietal peritoneum, or other contiguous portions, may be affected, and recovery from it is frequent, adhesions between the opposite surfaces only remaining, and these ultimately become more cellular and less extensive. The association of *splenitis* with partial peritonitis, in a slight and chronic form, giving rise to adhesions, &c., is not infrequent, especially in marshy situations.

74. *b.* The complication of *gastritis* with peritonitis is much less common than that of he-

patitis, but, like it, is much more frequent in warm than in temperate climates. It is, however, a much more severe and dangerous malady. The symptoms are violent, the vomiting is almost constant, the vital depression extreme, and the progress to a fatal issue generally rapid. In the few cases of this complication that I have observed in this country, the peritonitis has been partial.

75. *c.* The association of peritonitis with *enteritis*, or with *inflammations of the cæcum* or *colon*, is not infrequent, particularly in warm climates, and in persons who have migrated from Europe it is more commonly observed than in natives. In all such cases the disease generally commences in the mucous surface of some portion of the intestinal canal, and extends through the other tunics to the peritoneal coat, agglutinating the opposite surfaces of the bowels with each other, or with those of other organs or parts. In cases of inflammation of either the small intestines, the cæcum, or colon, the resulting peritonitis is most frequently partial, the disease sometimes terminating rapidly in gangrene, especially when the *appendix cæci* is affected, or when strangulation exists. When, however, there is perforation of a portion of bowel, or when this complication occurs in the course of exanthematous or continued fevers, or of dysentery, the disease of the peritoneum is more or less general, and is rapidly fatal, as described above (§ 27, *et seq.*).

76. *d.* The association of peritonitis with *diseases of the sexual and urinary organs*, or with inflammation of any of these organs after surgical operations, often occurs, particularly in persons of a bad state of health or constitution. The peritoneal inflammation may be partial or general, sthenic or asthenic; but, when general, it is usually also asthenic; and it may be associated either with hysteritis, cystitis, nephritis, or with inflammation of the ovaria or fallopian tubes, or with any two or more of them. These complications are almost always present in puerperal peritonitis, and are also sometimes observed in other circumstances. Partial peritonitis not infrequently follows inflammatory and organic diseases of the uterus and ovaria, and when thus associated, or when complicated with inflammation of either the sexual or urinary organs, sometimes terminates favourably, adhesions of contiguous surfaces, however, generally remaining in these, while serous effusions take place in the more unfavourable cases.

77. *B.* Complications seldom arise from *the extension of peritonitis to the organs which the peritoneum invests*; for, when the peritonitis is general and acute, death commonly takes place before inflammation in a distinct form, or other organic change, is developed in any of these organs; and when the peritonitis is partial or chronic, the affection of contiguous or enclosed viscera is more functional than structural. In children, however, and even in adults, both partial and chronic peritonitis may be associated with mesenteric disease, or with tubercles in the mesenteric glands and in the lungs. In these cases, also, there may be a farther complication with ulceration of the intestines, the ulceration sometimes perforating the coats of contiguous convolutions of intestines, and forming fistulous communications between them. It is doubtful, however, whether the peritoneal inflammation or the tubercular formation be primary; it is even not improbable that the former is the consequence of the latter in some instances, although the existence of tubercles in the false membranes, or within the peritoneum, shows that the inflammation has preceded the tubercular productions. In many cases of chronic tubercular peritonitis, the ulcerations and other lesions of the intestines are manifestly consequences of the peritonitis, while in others the ulceration seems to be primary, or the sequence of organic lesion cannot be readily established.

78. *a.* When peritonitis commences about the liver and extends to the diaphragmatic peritoneum, the *pleura* of the same side not infrequently, also, becomes inflamed, partial peritonitis thus becoming complicated with *pleuritis*, and ultimately even with *pleura-pneumonia*. I have met with several instances of these complications in the course of my practice, and in most of them complete recovery has taken place. The association of general peritonitis with pleuritis of one, or even of both sides, is frequent in puerperal peritonitis, particularly as occurring in lying-in hospitals, especially if the disease be not arrested at an early stage. (*See* Puerperal Diseases.)

79. *b.* Tubercular peritonitis in children is sometimes complicated with *tubercles in the membranes of the brain*, with softening of the central parts of the brain, and with serous effusion into the ventricles, or *acute hydrocephalus*. In these cases, of which I have seen several, the lesions of the peritoneum and of the brain and its membranes, were consequences of inflammation in connexion with tubercular productions, in scrofulous constitutions.

80. VI. Appearances on Dissection.—i. After Acute Peritonitis.—The changes produced by acute inflammation of the peritoneum vary with the severity or activity of the disease, with the habit of body and constitution of the patient, and with the predisposing and exciting causes; they differ most essentially according as the disease presents *sthenic* or *asthenic* characters (§ 8, 26), as it occurs *primarily* or *consecutively*, and as it has been preceded by, or is associated with, depression of vital power, or contamination of the circulating fluids. I shall therefore describe, 1st, those changes which are observed in the more *sthenic forms* of the malady, or those affecting persons whose vital powers are not exhausted, and whose circulating fluids are uncontaminated; and, 2d, those alterations observed in *asthenic states* of the disease, reserving, however, a more detailed account of these latter, until they come under consideration in the article on Puerperal Diseases.

81. *A. After acute Sthenic Peritonitis.—a. The earliest change* in acute peritonitis is a loss of the polish of the free surface of the membrane, which assumes a dull, opaque, and occasionally a dry-like appearance. Red vessels are seen, either grouped in spots, forming a number of puncta, or in streaks. The surface, appearing dull, or even dry, is, upon a closer examination, found to be covered by a most delicate, unctuous, and slightly viscid exudation. The dense cellular tissue connecting the peritoneum to

the parts underneath, or at least the attached part of the membrane, is the situation in which the increased vascularity seems to commence. Even at this stage, the former is somewhat infiltrated with an albuminous serum, giving the subserous tissue a thickened aspect, in which the membrane itself appears to participate. The peritoneum may he detached from the parts it covers with greater facility than in the healthy state, owing to diminished cohesion, and infiltration of the inflamed subserous tissue. As yet, the minute capillaries, forming puncta, or streaks, or assuming a reticulated appearance, interspersed with red points or spots, consist of the colourless vessels of the membrane enlarged, so as to admit the red globules; but, as the disease advances, the vessels appear more and more superficially. The small spots become more extended, approach each other, and at last coalesce, so as to form patches of various dimensions. The membrane itself is not, as yet, materially thickened, beyond the slight degree just noticed, produced chiefly by the change in the subjacent cellular tissue and its adhering surface. The redness now becomes more intense, deep, and extended. This may be considered as the *first stage* of the changes caused by acute inflammation, and is attended by intense pain, tenderness on pressure of adjoining parts, a quick, hard pulse, and symptomatic fever. It seldom exceeds three days, and sometimes does not endure twenty-four hours, until farther lesions supervene.

82. *b.* The most remarkable of these lesions is the *exudation of lymph* on the inner or unattached surface of the membrane. This is effused in a fluid state, and at first is an increased exudation of the viscid matter already noticed as giving a dull and an opaque appearance to the membrane. This exudation becomes more copious, especially as the surface is more crowded by capillaries injected with red blood. It is generally of a straw colour, homogeneous, gelatinous, semi-transparent, and coagulable, gluing together, as it were, in a slight degree, those free surfaces of the inflamed membrane which come in contact. Sometimes the reddened colour of the surface is heightened by the exudation being red and sanguineous, and adhering closely to it, giving it a villous appearance. Sometimes the exudation is of whitish or whitish-gray colour. With the exudation of lymph, the redness becomes more extended; in some it is nearly limited to the parts covered by, and to those slightly adherent to the opposite surface through the medium of, this exudation. In other cases the redness extends, in a somewhat less degree, in bands or stripes, along the surfaces between the parts covered by this exudation; these intermediate surfaces being either nearly dry or apparently so, and as yet not advanced to the stage of effusion. As the exudation proceeds in the more acute cases, it becomes more abundant, and varies in quantity and density, according to the activity and duration of the disease, and constitutional energy of the patient. It constitutes the *coagulable lymph* of Hunter and other British pathologists, and the *albuminous exudation* of Continental authors, from the large proportion of albumen which enters into its composition.

83. When this substance is minutely examined about the fifth or sixth day of the disease, or about the third from the commencement of its formation, it is generally of a pulpy consistence, partially translucent, of a straw-yellow or grayish colour, and, when torn asunder, presents a cellular or cellulo-filamentous structure in its denser parts, from which more or less serous fluid escapes. Separated from the membrane on which it has been formed, its adherent surface is rough, irregular, minutely honey-combed, and marked by more or less numerous minute dots of blood, arising from the disruption of the recently-formed capillaries passing from the inflamed serous surface into the new product. Here we have the most complete example of the formative process being one of the characters of inflammation occurring in persons of a previously healthy state of system.

84. *c.* This exudation, which is fluid when first poured out, and has rapidly assumed the state now described, experiences farther changes during the continuance of life. These, however, vary with the different states of the disease and circumstances of the case. One of the most constant, is the agglutination of the opposing surfaces of the inflamed membrane. To occasion this, it is not necessary that both the opposing surfaces shall have been previously inflamed; for the lymph effused from the primarily inflamed surface, coming in contact with a circumscribed portion of the opposite surface, irritates and inflames it only, and thus increases the quantity of the effused lymph, which becomes a connecting medium between the inflamed surfaces; capillaries, carrying red blood, passing from both surfaces into the effused lymph, so as to change and organize the substance still farther. In cases of this kind, the portions of the peritoneum intermediate between the parts, whose accretion has been thus effected, have frequently presented little or no appearance of inflammation; or have been moistened only by a small quantity of a sero-albuminous fluid, or have contained a larger quantity of a similar effusion.

85. *d.* The *connexion* or *adhesion* thus formed between the opposite points or surfaces of the peritoneum varies much in its characters with the period which has elapsed since the effusion of the lymph which produced it, and with the surfaces which it exists between. At first the exudation is fluid, but it soon coagulates into a gelatinous, pulpy substance of various density, exhibiting a weak cellulo-filamentous structure, enclosing in its meshes the serous parts of it, and easily separated from the surfaces it either covers or connects. After a time its cellulo-filamentous structure becomes more firm, and is penetrated by minute capillary vessels, shooting into it from the inflamed membrane, to which it is now more strongly attached by means of the vessels passing into it. The process of organization of the plasma or effused lymph has now commenced, and it proceeds more or less rapidly. The vessels penetrating the newly-formed substance are now more numerous, so as to admit of injection in fatal cases; its cellulo-filamentous structure becomes firmer, more opaque, and somewhat whiter; it is firmly attached to the serous surfaces, which it connects more or less closely, and the serous portions of the exuded

lymph contained between the meshes or cellules of the cellulo-filamentous structure, are absorbed. This substance is now nearly altogether albuminous, and, as the inflammation which produced it declines, the vessels penetrating it contract, so as ultimately to convey only the colourless portion of the blood. This contraction of the vessels, after the decline of the inflammation which formed them, is also accompanied by a great reduction of the bulk of the newly-formed substance, if not to its entire removal, especially when the inflammation and the albuminous exudation are limited, recovery from the attack taking place.

86. *e.* In less acute, or, rather, sub-acute or partial forms of peritonitis, or when the more acute symptoms have been subdued, and where inflammation has existed from fifteen to thirty-five days, or even longer, before producing death, the albuminous exudation forms false membranes of a grayish, whitish, or even reddish colour, establishing adhesions between contiguous parts, and varying in thickness from half a line to three lines, generally in proportion to the duration of the disease. When detached from the serous surfaces which produced them, and to which they adhere firmly, these surfaces are found much inflamed, and sometimes dotted with minute specks of blood, owing to the rupture of the connecting capillaries. The false membrane itself is here found firm and elastic, and not pulpy and friable, as in the most acute cases, or in those which have more rapidly terminated in death. In these cases little or no effused fluid is observed, that which may have been poured out with the albuminous formation during the earlier period of the inflammation having been absorbed.

87. According to the violence of the inflammation, to the duration of it, and to the constitution of the patient, sthenic acute peritonitis may give rise to *false membranes*, *membranous adhesions*, *cellular adhesions*, or *cellular bands*, and these may be the chief or only changes produced, beyond the increased vascularity of the membrane underneath. But in many cases other changes supervene. The chief of these concern the morbid productions themselves, the nature and character of the fluids effused, in connexion with these productions, and the state of the membrane itself and of the subjacent cellular tissue.

88. *f.* Where the *false formations* are considerable, and have assumed an *organized* and *cellular structure*, the vessels proceeding to them are very minutely divided when they have reached the peritoneal surface, and are about to pass into the morbid production; but, having passed into it, they again unite and form larger vessels, which ramify in different directions through this production. This distribution has led some pathologists to suppose that these vessels are first formed in the morbid productions, as in the envelope of the vitellus of the incubated egg; but this is not the case, as is shown by the manner in which the capillaries shoot from the inflamed membrane into the lymph thrown out upon its surface (§ 83, 84).

89. The morbid formations become firmer and less vascular, after they have been organized, as the period from their production is prolonged (§ 85). They also become thinner as they grow older, and their surface assumes the appearance of a serous membrane, while their internal structure is more strictly cellular. When bands of adhesion stretch from one surface to the other, or when laminated productions extend over a large superficies, or connect opposite parts, they are cellular in the centres and serous on their unattached surfaces, and, at all the points of adhesion with the peritoneum, this membrane has lost its serous characters, the sub-serous cellular tissue being continuous with that which forms the centre of these bands, false membranes, or adhesions.

90. The progressive diminution of the volume of those productions with the subsidence of the inflammatory action which produced them, and with the lapse of time, as well as the history of cases, in which there has been sufficient reason to believe that those productions had been actually formed, have led several pathologists to infer that they may be removed altogether. M. Villermé was the first to contend that the adhesion formed between the surfaces of different organs sometimes separate after a time at their centres, and disappear, and the observations of Dupuytren, Bérard, and Gendrin confirm this inference. I have had reason in the course of practice to concur with this opinion, the justness of which is of practical importance, and should not be forgotten in our management of diseases in which the serous surfaces are implicated; and I further believe, that the diminution and ultimate disappearance of these productions are remarkably favoured by whatever promotes the vital powers, and favours the healthy performance of the several functions.

91. *g.* In acute and sub-acute peritonitis, a *fluid effusion* is either a concomitant or a consequence of the albuminous formation, or both. In cases of partial peritonitis it is most frequently the consequence, particularly of adhesions. In slight and more chronic cases, however, the effusion of a serous or sero-albuminous fluid is often the principal phenomenon. In the more acute cases, the liquid effusion is whitish-gray, or of a whey or milky appearance. In some it is unctuous, thick, or abounding in albuminous flocculi, of a whitish, yellowish, or lemon colour. In others it is turbid, greenish, or brownish-red, containing lighter-coloured flakes, but this effusion occurs more frequently in acute asthenic peritonitis, the colour proceeding from a slight admixture of the colouring matter of the blood. In the most acute cases of the sthenic disease, the effusion of much fluid seldom occurs until the powers of life are much exhausted, or until the extreme capillaries and pores have lost their tone, congestion of the venous capillaries either supervening or having already taken place.

92. In many cases, particularly in partial peritonitis, the adhesions, in their advanced or old states, are causes of irritation to the surfaces they connect, either exciting an increased exhalation from the adjoining unattached portions, or being themselves the seat of exhalation, the spaces between the adhesions becoming filled with fluid, either of a serous, a sero-albuminous, or sero-purulent character, according to the degree of morbid action in the part and the state of the system. This accumulation of fluid in the spaces between the adhe-

sions, or in cavities the parietes of which are lined with an albuminous exudation in the form of a false membrane, is often owing either to a slight return or exacerbation of the inflammatory action after it had subsided to some extent, or to its continuance in a less severe or chronic form, after the more acute stage had been mitigated. But, in either case, congestion of the venous capillaries, and impaired tone of the affected vessels and tissues, are more or less concerned in the production of the fluid effusion. When the accumulation is large, it constitutes a species of *acute dropsy*, and is dependant upon the same pathological states of the containing membrane and surrounding parts as have been explained when treating of the origin and nature of dropsical effusions.

93. The effusions of coagulable lymph, and the consequent adhesions, are remarkable chiefly between the various convolutions of intestines, between the prominent points of these and the omentum, in the pelvic and iliac regions, and between the serous surface of the bowels or of the other abdominal viscera and the peritoneum lining the parietes of the abdomen. In some, the greater number of the folds of the intestines are agglutinated together, and these partially cemented to the omentum, or to adjoining viscera or surfaces, by means of an opaque lymph, of a lemon-yellow colour and pulpy consistence. In others, the agglutination is more partial, and the omentum is shrunk or contracted, and drawn up to the arch of the colon. In some of the most acute and violent cases, the surface assumes a purplish-red or violet colour, and in these the intestines are often united to each other, or to the opposite surfaces, without the intervention of a false membrane, beyond a very thin film of a whitish or grayish albumen.

94. In cases of partial peritonitis, when the disease has been of longer duration, or when the patient has recovered, adhesions more or less extensive, or bands of various dimensions, are often formed between various parts of the opposite surfaces, or between the omentum and one or more of the convolutions of the intestines, between the margin of the omentum and fundus of the uterus, or between other parts, according to the particular seat and circumstances of the partial peritonitis of which these adhesions were the consequences. These albuminous exudations and adhesions present other forms, especially in sub-acute and chronic cases, and are often attended by more or less fluid effusion of a similar description to that now noticed.

95. The *peritoneum itself* is often variously changed, besides being injected in the manner already noticed, and generally the change implicates more or less the sub-serous tissue; indeed, this latter seems often more particularly altered, being œdematous, or infiltrated by coagulable lymph in some cases, and softened in others. In these, the peritoneum is frequently also more or less softened, or more readily torn, and somewhat thickened. In the most acute cases, this membrane becomes in places of a deep brownish red or purple colour, or even almost black, but it very rarely advances to *gangrene*, unless in partial peritonitis caused by strangulated hernia, or by inflammation of the appendix of the cæcum, and then this lesion is limited to the part thus circumstanced, and the peritoneum only participates with the other tissues in the change. M. Scoutetten remarks, that he has met with black gangrenous eschars of a small size, and never exceeding one or two inches in extent. These, however, occur chiefly in the asthenic form of peritonitis, and even rarely in it, as death generally takes place before gangrene can supervene; and in those cases where it is observed on dissection, it is most probably a *post-mortem* change, or at least very shortly antecedent to, or concomitant with, dissolution.

96. The changes just described, particularly as respects the membrane itself and its false productions and adhesions, are often *partial* or limited, and when this obtains, they are observed more frequently in the peritoneum lining the pelvic viscera, the cæcum, and appendix, and next most frequently in parts of that reflected over the large and small intestines, the liver, diaphragm, and either surface of the omentum, and less frequently in the transverse meso-colon and mesentery, that covering the stomach being most exempt from them.

97. *B. The lesions consequent upon asthenic peritonitis* differ materially from those caused by the sthenic form of the disease. While in the latter they are more frequently partial or limited, in the former they are more general, or, at least, extended; while, also, in the sthenic disease, albuminous lymph, false membranes, and adhesions are frequently the chief or only changes, in the asthenic these are very rarely observed, or in a very imperfect and unorganized and unorganizable form. In some cases, a thin muco-albuminous or soft and dark-coloured film is found extending over the surface of the inflamed membrane, and a large quantity of a turbid serum, of every shade of colour, from a whitish or grayish hue to a brownish dark sanguineous or sanious appearance, is effused in the peritoneal cavity. This fluid varies in quantity from a few ounces to several pounds, but it is very rarely above this amount in the acute form of the disease. It seldom contains the large flocculi or masses of coagulated lymph or albumen sometimes met with in the more sthenic form of the malady, unless in those cases which approach more or less to that character.

98. The peritoneum often presents a softened or sodden and somewhat thickened appearance, in which the subjacent cellular tissue participates. It is generally more readily torn, and, in some cases, I have found this greater lacerability very remarkable, particularly when there was much dark discoloration of the surface, which is more or less altered in colour, being commonly of a dark brownish, grayish brown, or purplish tint, the shades varying in different situations. Various other appearances are often observed in this membrane, in the viscera over which it is reflected, and in the fluids effused into its cavity; but, as these most frequently occur in the puerperal states of peritonitis, they are described in the article Puerperal Diseases.

99. ii. Lesions caused by Chronic Peritonitis.—When the peritoneum has been chronically inflamed, the lesions which present themselves are very various according to the con-

stitution of the patient, and the duration of the disease. But they differ also most remarkably according as they proceed from an inflammation which has become chronic, consecutively upon an acute form of the disease, and as they result from a slow, insidious, almost latent, and primary state of inflammatory irritation or action, according as they are *consecutive* or *primary*. They differ, moreover, as the peritonitis is simple or associated, as it is *non-tubercular* or *tubercular*.

100. *A. The changes which follow chronic peritonitis consequent upon the acute* vary with the duration and circumstances of the case. — *a.* In some, after the duration of fifty or sixty days, the peritoneal cavity is filled with a considerable quantity of a whitish serum, occasionally resembling partially curdled milk. Numerous bands of adhesion and portions of false membrane presenting the same appearances, and formed as above (§ 81, *et seq.*) described, unite the greater part of the intestines to each other, or line the intestinal peritoneum and omentum. These false membranes often form partial sacs, containing a fluid, the characters of which are various. When the false membrane is detached, the portion of the peritoneum underneath has not so red or so vascular an appearance as in the acute disease; sometimes, indeed, it is hardly coloured. In many of these cases, the quantity of fluid effusion is inconsiderable, and the false membranes are less extensive and thinner, opposite surfaces being united by adhesions or bands, and not by continuous albuminous layers.

101. *b.* In some subjects, a considerable quantity of a yellowish limpid serum, without clots or flocculi, is found in the peritoneal cavity about this period of the disease, but without any trace of false membrane or adhesion, the peritoneum being, however, reddened, thickened, and injected. The omentum, in these, is very much thickened, red and fleshy, and sometimes contains small vesicles or cysts.

102. *c.* In other cases, and particularly at a later period of the disease, the abdomen is distended by the accumulation of serum. The intestines are pushed towards the vertebral column, and sometimes adhere slightly, or more or less extensively, to each other. The peritoneum is generally thickened and papillous, having a grayish, lardaceous appearance, occasionally with bloody striæ and red spots, seemingly formed by slight extravasations of blood. In some of these cases, furrows or broad superficial erosions are formed in the thickened peritoneum. The fluid collected is occasionally clear and yellowish; in some it is turbid, grayish, brownish, or even sanguineous, particularly where the bloody striæ or spots are observed in the thickened membrane. In rare instances *hemorrhage* has occurred, owing to the destruction of small vessels by the superficial erosions just mentioned. These erosions in rare instances become more and more deep, and are converted into *ulcers*, which destroy the membrane and advance to the subjacent tissues, forming the primary peritonitic ulcers of Scoutetten.

103. *d. Gangrene* very rarely is observed in chronic peritonitis, and only when a recurrence of the acute disease takes place, or when acute inflammation attacks the subjacent structures, and then only limited portions of the membrane are implicated. In these, eschars of a grayish slate or dark colour are formed, their surfaces being covered by a dirty, grayish matter. The eschars in these instances generally extend to the subjacent tissues.

104. *B. The lesions consequent upon primary non-tubercular peritonitis* are, in some instances, not very different from the foregoing, in others they differ materially. — *a.* Very slight *redness* of the peritoneum is often observed, and as frequently this is entirely wanting. When it occurs, it is usually of a brownish shade. If more remarkable, or of a brighter tint, it is then owing to an acute state of inflammation, which had supervened upon the chronic, and terminated life; but, in these cases, other marks of acute action are often found united to the characteristic alterations of the chronic.

105. *b. Thickening* with increase of density is one of the chief changes observed in the primary form of chronic peritonitis. The thickening is owing not only to increase of the membrane itself, that being seldom very great, but also to infiltration and tumefaction of the subjacent cellular tissue, identifying it completely with the serous coat in such a manner that it is impossible to distinguish the exact limits of this membrane, particularly in very chronic cases. The difficulty is also much increased by the organized false membranes often formed upon the peritoneum, and which become ultimately identified with it, in such a manner as themselves to become inflamed and to give rise to similar productions.

106. *c.* The increase of *density* of the chronically inflamed peritoneum is usually considerable, so that it is generally torn with greater difficulty than in the healthy state, or especially after acute inflammation. It is detached also with much more difficulty from the subjacent parts, owing to the increased density of the connecting cellular tissue, and is much less friable than in the acutely inflamed state.

107. *d.* The surface of the membrane is rugose, dull, and presents a number of small elevations, which are perceptible to the touch as well as to the sight, are whitish, somewhat flattened, and irregularly intermixed with brownish specks; these specks resemble those which are observed in acute inflammations, and occasion no elevation of the surface. These small elevations, although generally observed on the surfaces of the thickened membrane, are not confined to these surfaces, being frequently also found on false membranes; they are usually called *granulations*. Some have confounded them with the tubercles which sometimes are developed, either under the inflamed peritoneum, or in its substance, or in the false membranes. They may, however, be distinguished from these latter by the following marks: the small, whitish, flattened granulations arise upon an exhaling surface, and seem to elevate an epidermis whiter and more opaque than the serous texture itself, indicating that they exist in the substance of this membrane. Around them there is always observed a slight vascular injection, very evident under the microscope, and sometimes apparent to the unassisted eye. Upon dividing the membrane, a minute infiltration of whitish serum is observed at the points where the granulations have

been divided, with a slight increase of thickness of the parts of the membrane where they are developed. They are not enclosed in any cyst, but are mere infiltrations into the structure of the part in which they are formed, as first shown and contended for by me in a memoir on chronic peritonitis, published in 1821 (see *Lond. Med. Repos.*, vol. xvi.), and since confirmed by M. Gendrin and others.

108. *e*. The false membranes found in this state of peritonitis are completely organized and dense. Occasionally they are indurated, of a fibrous or lardaceous structure; in other cases they are entirely wanting, and it is in these latter that the thickening of the peritoneum has taken place, chiefly in the direction or at the expense of the subjacent cellular tissue, the free surface of the membrane appearing as a rugose epidermis of a dull, grayish-white colour, elevated by numerous granulations, and spread over a thickened and indurated coat of the connecting cellular tissue. In other, but rarer cases, the peritoneal cavity is nearly obliterated by dense false membrane, indurated or cellular in parts, or united to the opposite surfaces by large bands; or then by one mass of indurated cellular tissue, having its areolæ filled with a gelatinous substance. In some instances the false productions consist of several layers, of different degrees of thickness and density. They are not always, as M. Gendrin has shown, closely adherent to the subjacent peritoneum, being sometimes separated from it either by an effused fluid, or then by more recently-effused lymph, owing probably to an acute action having taken place shortly before death.

109. *f*. In a few cases the peritoneum presents a brownish or very dark colour, is less dense and coherent than usual, and is infiltrated, particularly in parts, by a dark-coloured blood. At first sight the membrane seems to be gangrenous, but, on examination, it is not disorganized, its surface being rugose, granulated, and sometimes elevated by small ecchymoses, or clots of dark blood, effused under its surface or in its substance. This change is observed only in persons of a cachectic, scorbutic, or broken-down constitution. M. Gendrin views this alteration as a complication of hæmorrhagic congestion with chronic inflammation. Occasionally it is accompanied with an exhalation of bloody serum into the cavity, and very rarely with a puriform exudation on the surface. In this latter case it may be presumed that a subacute state of inflammatory action had taken place shortly before death.

[Andral is of opinion that this melanotic deposite, when in layers, is nothing more than false membrane infiltrated with melanotic matter. Others contend that the discoloration of false membrane does not proceed from melanosis, but from a blackening of the blood in the false membrane by intestinal gases and acids. It is also maintained that genuine melanosis in layers on the peritoneum is an independent secretion, forming either a mere pigment on the serous surface, or a more substantial stratum of a jelly-like consistence, enclosed in a delicate web-like membrane of new formation, and capable of being dissected off without injury to the peritoneum itself. It may be doubted whether the melanotic deposites which are found adherent to the peritoneum, in round pedunculated tumours, isolated or agglomerated, are the result of chronic peritonitis, as they are more commonly situated on the omentum, and covered by a fine membranous film of their own.]

110. *g*. If acute inflammation have supervened upon the chronic, and continued for some days, it may produce not only albuminous formations, but also vascular injection of the part of the peritoneum thus affected. This injection may be either punctated, striated, or even general; and in this last case the surface of the membrane is sometimes lined with a puriform or perfectly purulent matter.

111. *C. Tubercular chronic peritonitis*, although generally assuming a chronic character, does not always commence as such; and, even when it is primarily chronic, as it is most frequently, it may pass into the acute, at least in a partial or limited manner.—*a*. At an early stage of the disease, coagulated lymph, in the form of a soft, false membrane of a grayish yellow colour, and amorphous, is thrown out upon the inflamed surface. The organization of this substance soon commences, but in a morbid state; small whitish grains soon appear in this hitherto amorphous production, which presents a few rudimental vessels. These grains are diaphanous, more dense than the coagulated lymph containing or surrounding them, and from which they are readily separable. When viewed by the microscope, they are seen surrounded by a vascular net. The false membrane forms adhesions to the peritoneal surface that are more intimate where these small grains or concretions, the commencing tubercles, are most numerous. These adhesions soon become very intimate, the false membrane more vascular and more organized; and the inflammation, if of an acute character, passes into the chronic state; and the serous surface, and the false membrane covering it, are still more intimately united, so as to form apparently but one very thick coat, in the substance of which the tubercles are developed and adherent. This membrane is often very vascular, the capillary vessels passing into it being often very large; the tubercles acquiring considerable size, and being much larger than the granulations above described (§ 107). The tubercles do not exist, as is the case with the latter, in the substance of the peritoneum, but are formed within the false productions, and at the same time with them; while the granulations are found only after these productions are fully formed, when seen on the surface of them, and in consequence of their inflammation.

112. *b*. Although tubercles cannot be said to exist in the peritoneum itself, yet they are often found in the sub-peritoneal cellular tissue, and are to be distinguished in this situation, as well as in false productions or membranes, by their being always encysted; the tunic or cyst arising from the condensation of the cellular tissue in which the tubercular matter is effused. When these tubercles form in the mesenteric or omental subserous tissue, they often reach a larger size than when they occur in the sub-serous tissue of the intestines, and are much more numerous. Dr. Hodgkin remarks, that in the latter situation they appear as if the part were sprinkled with parti-

cles of rice. They are often surrounded by a vascular areola, the tint of which varies with the colour of the blood injecting the capillaries forming the areola, and are readily distinguished from the miliary granulations found in the peritoneum itself, in the manner above noticed (§ 107).

113. *c.* Chronic tubercular peritonitis is often associated with *ulceration* and *perforation* of the intestines, sometimes so extensive, as I have occasionally observed, particularly in children, as to form direct fistulous communications between distinct but contiguous convolutions. These communications may arise from primary ulceration of the mucous coat advancing to the peritoneal, and producing consecutive, partial, or more general peritonitis, of a subacute or chronic form, independently of tubercular formations; but they are more frequently attended by these formations, and then it is doubtful, at least in some cases, whether the ulceration has commenced and proceeded in this way, or has originated in the situation of the tubercles, which, being softened, are followed by ulceration and perforation of the bowel from without inward. Dr. Hodgkin remarks, that puriform collections, varying from the size of a pea to that of an orange, sometimes form in those situations in which the exudation of concrete lymph is greatest, as in the angular and lateral parts of the abdomen, and that these collections are often attended by ulcerative absorption of those points of the peritoneum in contact with them, the ulceration extending to the subjacent coats, until a communication between these collections and the canal of the bowels is effected. The ulcerations thus consequent, 1st, upon softened tubercles, formed either in the plastic lymph, or beneath the peritoneum; and, 2d, upon the purulent collections just mentioned, may, severally, give rise to communications not only between different parts of the bowels, but even between the intestine and the external surface, thereby producing artificial anus.

114. *D.* After this, as well as after the preceding form of chronic peritonitis, the peritoneal cavity frequently contains more or less *fluid*, which is usually opaque, of a whitish yellow colour, sometimes milky, and occasionally of an unpleasant or even fetid odour, particularly when this membrane has been long inflamed.—*a.* In a few cases the fluid partly consists of a mucopuriform matter, whitish, of the appearance of a semi-concrete albumen, mixed with pus; in others it is nearly puriform, but much more frequently it is limpid, or it resembles clear whey. In very rare instances it is gelatinous, with a thicker gelatinous or slimy coating over all the inflamed surface. The quantity of fluid effused is variable; sometimes it is so great as to distend the abdomen; when in smaller quantity, the cavity is partly filled with false membranous productions of a cellular texture, occasionally infiltrated with pus. In a few of these cases the inflamed cavity has its capacity somewhat diminished by a sinking inward of its parietes, an alteration observed after the disease had appeared to tend toward recovery.

115. *b.* In those cases attended by liquid effusion into the peritoneal cavity, the *omentum* is contracted or corrugated under the greater curvature of the stomach, and often reduced to a small size. If, however, an old adhesion have taken place between some part of it and an adjoining surface, the omentum is usually found extended in the form of a chord between the stomach and the part at which the adhesion exists.

116. *E.* Dr. Hodgkin remarks, that in chronic peritonitis the *mesentery* is found more or less shortened, by which the intestines are drawn up to the spine; and if a hernia had existed, it will sometimes be found completely reduced. The *intestines* are reduced more frequently in their length than in their calibre. "In extreme cases," he adds, "they probably lose nearly or quite half their dimensions, and the valvulæ conniventes are consequently placed close to each other. This contraction of the omentum, mesentery, and intestinal canal seems to depend on the contractions which newly-formed parts undergo after they have become organized or permanent, as in the large cicatrices of extensive burns." This shrinking evidently depends upon the false membranes covering the peritoneum, and partly upon the deposite on the attached surface. The original structures, also, are probably themselves reduced by absorption; partly under the influence of the contraction of the adventitious deposite, and partly under the pressure of the fluid effusion. These contractions were first noticed and explained by Dr. Hodgkin, in his work on "*the Pathology of Serous Membranes*" (p. 152).

117. *F. Cartilaginous or semi-cartilaginous induration and thickening* are sometimes met with in parts of the peritoneum in consequence of chronic inflammation. This change is much more rarely seen in this membrane than in the pleura; but it has been remarked by Sandifort, Portal, Cruveilhier, and others. I have met with this change twice in that portion of the peritoneum investing the spleen, and once in that covering one of the ovaries, the situations, I believe, where this change is most frequently observed.

118. *G. Ossification of, and ossific deposites in,* the peritoneum, have been noticed by authors, particularly in the omentum, sometimes in connexion with osseous, calcareous, or cartilaginous tumours. Most of these instances are not strictly referable to the peritoneum, this membrane being only consecutively implicated. Others are probably only cases of calcareous deposits under the peritoneum, resulting from ultimate changes in tubercular matter in that situation.

119. *H. Gaseous fluids* are sometimes found in the peritoneum, generally in connexion with the effusion of serum, and with one or more of the other lesions already described. The question as to their source has been often agitated; but I agree with Baillie, Hodgkin, and others, that although the peritoneum may, in a state of disease, secrete a gaseous fluid, yet that most generally this fluid is the result of cadaveric change when found in this situation. But there still remains another question: may not the gaseous fluid he evolved during the life of the patient from the changes in, or partial decomposition of, the products of inflammation lodged in the peritoneal cavity? This result is by no means improbable, when the quantity,

the nature, and the physical condition of the effused fluids are considered, and when the inefficiency of the vital influence in this disease to prevent those changes to which these fluids are prone is taken into the account. My experience of this disease, particularly in its asthenic forms, and in the puerperal state, leads me to infer that the effused fluids actually undergo in the peritoneal cavity, during the life of the patient, and at an advanced stage of the malady, such changes or such partial decomposition as produce gaseous fluids, which aggravate the symptoms, and which, by their partial absorption, contaminate the blood. Many years ago I contended that this was the principal source of the gaseous fluids sometimes found in the peritoneum and pleura in connexion with the products of inflammation; and the opinion is now entertained by several pathologists.

120. VII. Diagnosis.—The *diagnosis* of peritonitis is often extremely difficult, particularly the partial and chronic states of it. Partial peritonitis, whether acute or chronic, is so frequently consequent upon, and associated with, inflammation of the organ or organs which the inflamed peritoneum invests, that it is often difficult to form a correct idea as to the part affected, either solely or principally. Still, the history of the case, in connexion with its causes and the early symptoms, and the grouping of the existing symptoms especially characteristic of peritonitis, particularly the abdominal pain, tenderness, swelling, and tension; the position and aspect of the patient; and the states of the pulse, stomach, and bowels, when duly weighed, will generally guide the physician to a correct conclusion. Even in those cases which are consecutive of inflammation of the enclosed viscus, and which are strictly partial, the characteristic phenomena of peritonitis are usually present, although more or less limited to the situation affected. These are the acute, burning, or sharp pain, swelling, tenderness, and tension; the position best calculated to take off pressure from the seat of disease; the sharp and anxious countenance; the quick, sharp, hard, constricted, or small pulse; the short, small, frequent, and thoracic respiration; the dread of coughing, sneezing, or of a full respiration; the retchings, vomitings, or flatulent eructations; and the symptomatic fever, in various grades of severity, according to the intensity and extent of the inflammation, whether partial or general; the chief difference being in the limitation or extension of the local symptoms.

121. When inflammation of one or more of the abdominal viscera is followed or attended by these symptoms, the inference that the peritoneum investing them is implicated, or has become chiefly affected, will generally be correct; and if these symptoms appear primarily, without any marked functional lesion having preceded them of the organs invested by the peritoneum, to which the symptoms are limited, it may safely be inferred that the peritoneum of that region is primarily and principally attacked, and the treatment should be directed conformably with this conclusion. The diseases for which peritonitis is most liable to be mistaken are, enteritis, gastritis, colic, rheumatism of the abdominal muscles, neuralgic and hysterical pains in the abdomen, &c. Of all these the diagnosis between enteritis and peritonitis is the most difficult.

122. *A. Enteritis* is with great difficulty distinguished from peritonitis; and in many cases the diagnosis can hardly be made, especially in that state of enteritis where the peritoneal covering of the small intestines is chiefly affected. (See art. Intestines, § 31, 69, 74). Cullen, Wilson Philip, and others have insisted upon the difficulty of the diagnosis in these cases; and when the peritonitis is limited to the serous covering of the intestines, or has commenced in this situation, it is certainly and necessarily very great; for the disease is, in truth, a partial peritonitis, becoming more and more extensive. Many of the diagnostic symptoms so strongly insisted upon by authors, who have copied their descriptions of disease from those who have written before them, instead of writing from their own observation, either are fallacious or occur only in certain circumstances. Thus the greater sensibility or tenderness of the abdomen, and the more acute pain, said to distinguish peritonitis from enteritis, cannot be depended upon, for these will depend, in either case, upon the susceptibility and sensibility of the patient and the intensity of the disease. Neither can the states of the bowels be always viewed as offering any indication of importance. The confidence, indeed, with which diagnostic symptoms have been advanced by some recent writers tends more to mislead than to instruct the inexperienced. After long experience and tolerably close observation, I may remark, that all diagnostic symptoms, particularly between these diseases, should be cautiously estimated; and although it may not be of much importance, as respects the treatment, whether or not the one malady be distinguished from the other, still something may be gained, in this regard, as well as respects the prognosis, by a greater precision of information.

123. In the more general states of peritonitis the diagnosis is often not so difficult as in those just adverted to, or when the intestinal peritoneum is inflamed. Here there are often observed, although not always, greater and more general, and more superficial pain of a burning or acute kind; greater sensibility to pressure; more remarkable swelling and tension of the abdomen; less tolerance of motion of the body and of the abdominal muscles; a greater dread of coughing, sneezing, and of a full respiration, and less motion of the diaphragm, than in enteritis. Vomitings or retchings are generally not so early nor so frequent in peritonitis as in enteritis, although often equally so in an advanced stage of the former; but in many instances they are not very urgent until the disease is verging towards a fatal termination. The bowels are usually constipated in both maladies, unless in the more asthenic states of peritonitis, when they are sometimes even relaxed, especially in the low, infectious form of puerperal peritonitis.

124. *B.* The other diseases which are said sometimes to simulate peritonitis can hardly be confounded with it, if due attention be paid to the symptoms.—*a. Gastritis* will not be mistaken for it if the abdomen be carefully examined; for the seat of pain, the desire of cold fluids, the thirst, and early vomitings, always following the ingestion of fluids, will generally

indicate the affection of the stomach. If the peritoneal coat of this viscus is inflamed, the disease may be considered either as a form of gastritis, or as partial peritonitis, according to the views of the physician; but this portion of the peritoneum is the most rarely affected, at least alone, and in this climate. Some aid may occasionally be afforded in this case, as well as in others, by *auscultation*; for, although the motions of the diaphragm are generally slight, yet sometimes an imperfect or obscure rubbing sound is heard, with the respiratory movements, in the sthenic forms of peritonitis; and when much affusion takes place, and *percussion* is tolerated, a dull sound is emitted where the affusion is considerable. These modes of examination may assist in distinguishing peritonitis from the diseases just noticed, as well as from colic and some other maladies.

[We believe that Dr. Beatty, of Dublin, first called the attention of the profession to this physical sign in peritonitis in the year 1834. (*Dublin Jour. Med. & Chirurgical Science, Sept.*, 1834.) "In Jan., 1832," says Dr. B., "a woman, aged 30, was admitted into my ward for the diseases of females, in the City of Dublin Hospital, labouring under dropsy of the left ovarium. The tumour filled the abdomen from the pubis to the ensiform cartilage, and was remarkably hard and unyielding. A few days after admission, she was attacked with severe pain in the belly and febrile symptoms, which continued for a week, and required the abstraction of blood, and other antiphlogistic treatment, before she was relieved; during which time a remarkable sensation was communicated to the hand when applied over the umbilicus and its neighbourhood. The sensation was that of a grating or rubbing together of two uneven and rather dry surfaces, and was rendered most evident by ordering the patient to take a full inspiration, thereby causing the abdominal parietes to move more freely over the surface of the tumour. By the application of the stethescope, a loud and distinct 'frottement' was audible, extending over a space of about five inches in diameter, with the umbilicus for a centre. In a few days the pain and inflammatory symptoms subsided, under the treatment employed, and, with them, the sensation just described, and the audible phenomena altogether disappeared."—*Loc. cit.*

Sementini states, that in all cases of peritonitis, in whatever part of the abdominal cavity the inflammation is seated, there is pain in the pubes and upon the great trochanters; which, if not spontaneously felt, is always developed by pressure, and of which the severity is directly proportionate to that of the peritonitis. This fact, if, indeed, it be such, may be explained by the relation of the nerves of the parts, in which the pain is felt, to the peritoneum, and by its connexion with the fasciæ and muscles about them. In addition to its value in the diagnosis of even the most obscure and latent cases of peritonitis, in all of which, we are told, this sign is present in a degree proportioned to the severity of the disease, Dr. S. has found it of value as an indication of treatment, and has obtained great benefit from the application of leeches and blisters over the trochanters, instead of on the abdominal walls. —*Annali Univ. di Med.*, Sept., 1840]

125. *b.* Certain states of *colic* sometimes resemble peritonitis, especially when the former is attended by much abdominal distention and pain; for I have seen in some instances the tenderness on pressure so great, owing to the stretching of the peritoneal covering of the bowels by the flatus distending them, as to resemble peritonitis. In these the absence of fever, the state of the pulse, the cool or natural temperature of the abdomen, and other concomitant symptoms, will guide the physician. Still, the occasional supervention of peritonitis or enteritis in these cases should be kept in recollection. In the more common states of colic, when pressure is tolerated, or even gives ease, there can be no mistake as to the nature of the disorder. (*See art.* Colic.)

126. *c.* A *hysterical form of colic* and a *hysterical state of neuralgia* may somewhat resemble peritonitis, chiefly owing to the apparent tenderness of the abdomen, which, however, is tolerant of firm pressure unexpectedly made on it. In these cases the presence of other hysterical symptoms, the borborygmi, and the flatulent state of the digestive canal; the situation of the pain, and its connexion with uterine irritation, and occasionally with tenderness in some portion of the dorsal or lumbar spine; the absence of fever and of several other inflammatory symptoms; the states of the urine and of the catamenia, &c., will generally indicate the nature of the disorder. I have, however, met with cases of hysterical colic, in connexion with dysmenorrhœa, where the extreme tenderness, the acute pain and tension in the lower regions of the abdomen, the retchings and vomiting, and the disturbance of the circulation induced a dread of inflammation of the portion of the peritoneum reflected over the uterine organs; and, most probably, the congestion of these organs had so affected the peritoneal covering, either by stretching or injecting it, as to develope its sensibility, the removal of the congestion by the supervention of the discharge removing, also, the suffering with the cause.

127. In all cases, when the abdominal tenderness of *hysteria* most closely simulates peritonitis, a remarkable incongruity of symptoms is observed. The states of the countenance, of the pulse, of the tongue, of the evacuations, and of respiration are inconsistent with peritoneal inflammation. The breathing is hurried and laborious, and not suppressed, short, and shallow, as in peritonitis; the pain and tenderness shift, or suddenly appear and as suddenly depart; the catamenia are usually more or less disordered; and leucorrhœa is often present. In the hysterical affection the state of the temper and of the moral feelings, and the frequent occurrence of other hysterical symptoms, often of themselves sufficiently characterize the disorder.

128. *d. Rheumatism* rarely affects the abdominal muscles, but when it does it may be mistaken for peritonitis, owing to the intense pain felt on pressure and motion. Dr. Parr states that the pain in rheumatism of these muscles is felt chiefly at their origins and insertions, shooting to the false ribs and spine of the ilium. This, however, does not agree with my observation; for I have considered the sheaths and aponeurosis of the abdominal mus-

cles to be the chief seat of the rheumatic affection in those cases which I have seen. A careful examination of the abdomen, the state of the countenance, and the absence of retchings, and of the chief symptoms characteristic of peritonitis, will readily indicate the nature of the disease. It should, however, be kept in recollection that acute rheumatism of these muscles may be followed by peritoneal inflammation. Such instances are rare, but I have met with two or three. The pains and girding sensation, or feeling of tension around the abdomen, often attending irritation and inflammatory action in the spinal chord or its membranes, can hardly be mistaken for peritonitis, if the least attention be paid to the history and symptoms of the case.

129. VIII. Prognosis.—*A.* At an early period of *acute sthenic peritonitis*, much confidence may be entertained in a favourable result, although considerable danger should be apprehended until the good effects of active and prompt treatment become apparent. If, however, those effects are not manifested soon after the measures have been resorted to that I am about to advise at an early stage of the malady; if the disease have advanced far before suitable treatment was adopted; if indications of any of the unfavourable terminations mentioned above (§ 32, *et seq.*) have appeared; and if the case presents the *asthenic* form, or a complicated state, an *unfavourable prognosis* should be given; but hopes of recovery should not be entirely relinquished. The prognosis of peritonitis occurring in the *puerperal state* depends upon various circumstances peculiar to this state, and must be considered in connexion with Puerperal Diseases.

130. The most *favourable indications* are furnished by the symptoms already enumerated of resolution of the inflammatory action (§ 31) by a subsidence of all the painful and urgent symptoms. On the other hand, if the symptoms increase in severity, especially after judicious means have been administered; if the heat of the abdomen augment, or is more harsh; if the vomiting become more urgent; the pulse more frequent, smaller, irregular, or intermittent; the countenance more anxious and collapsed, or the extremities cold or clammy; if the breathing be very short, interrupted, painful, and attended by distress and restlessness; if singultus supervene with or without meteorismus, or a pumping-up of the contents of the stomach, or eructations of fluid matters, and if constipation be obstinate, no hopes of the recovery of the patient should be entertained.

131. The causes of the disease, and the various circumstances and complications attending and characterizing particular cases, should be duly estimated before we form or give an opinion as to the result. Thus, peritonitis caused by perforation of the stomach or intestines, or that appearing in the advanced course of continued and exanthematous fevers, or following abscess in, or the rupture of, any viscus, rarely or never admits of complete recovery. Peritonitis, also, following surgical operations involving the peritoneum, and that caused by or consequent upon, or connected with, erysipelas, is attended by very great danger, particularly in the crowded wards of an hospital, or in an impure atmosphere. Various other circumstances of only casual occurrence will also weigh with the intelligent physician when he forms his prognosis in any case.

132. *B.* The *chronic forms* of peritonitis very rarely admit of recovery in any case which is distinctly characterized. The slighter or even partial states, following the acute, may, however, be removed more or less completely by careful treatment and regimen, especially when affecting persons not far advanced in life, and of an otherwise good constitution; but the more general form of primary chronic peritonitis, and still more particularly the tubercular complication of it, should be considered as entirely hopeless, although life may be prolonged for some months.

133. IX. Causes.—The causes of peritonitis are many of those which most frequently occasion inflammation of other internal viscera and external parts (*see* Inflammation, § 91–121); but there are some causes which determine more especially the development of this disease, and which may be more particularly adverted to.—*a.* Many of these *act directly* upon the seat of inflammation; as wounds, operations,* bruises, lacerations, ruptures, displacements, strangulations of parts, &c., implicating the peritoneum more or less; great or unusual stretching or distention of this membrane; the passage into its cavity of matters foreign to it, as blood, chyle, bile, fæces, pus, tubercular matter or other morbid secretions, &c.; invaginations of portions of the bowels, or stricture or undue pressure of parts of them, or of the omentum by tumours, hands of old adhesion; inordinate and continued pressure by or on surrounding or adjoining parts, and prolonged and unusual exertion of the abdominal muscles, &c.

134. *b.* Other causes *act from contiguity*, as pre-existent disease of some viscus covered by the peritoneum, especially dysentery, diarrhœa, and ulceration of the stomach or bowels; enlargements or tumours of subjacent parts; inflammation of any of the viscera or structures enveloped by this membrane, particularly of the intestines, urinary bladder, uterus, ovaria, liver, and spleen; and malignant or other structural lesions of adjoining parts. This class of causes generally occasion partial or limited peritonitis.

[Peritonitis from perforation of the serous membrane is not an unfrequent affection, and may generally be distinguished by the suddenness of the attack, and the rapidity with which the disease runs on to a fatal termination, in spite of all medical treatment. The causes of this accident are, 1st, external injuries, either of the solid or hollow viscera of the abdomen, or of the parietal peritoneum merely; 2dly, rupture of the bladder from distention, and of the uterus during parturition; 3dly, rupture of some portion of the digestive tube, from softening of its coats; 4thly, ulcerative perforation of the serous membrane, arising either from disease in any part of the subdiaphragmatic portion of

[* Most cases of the Cæsarean section terminate fatally, from consequent peritoneal inflammation. Operations for tying the iliac arteries often cause death in the same way, as in a recent case, where the internal iliac was tied by Mr. Liston, of London, for a wound of a superficial artery of the thigh, received in a duel. Owing to the great danger of this result, operations for removing ovarian tumours are, in our judgment, altogether unjustifiable, and should be abandoned.]

the digestive tube; from suppuration of the solid viscera opening into the peritoneum; from ulceration of the bladder, or ovaries; or from perforation of the diaphragm by purulent collections on its thoracic surface. There can be no doubt that ulcerative perforation of the intestinal tunics often takes place, especially in typhoid fever, without an escape of the contents of the canal into the abdominal cavity, owing to adhesions being formed between the two surfaces of the peritoneum at a point corresponding to the situation of the ulcer. Again, owing to inflammatory adhesion, and subsequent ulceration of different portions of the intestinal tube, we sometimes find communications thus formed, the fœcal contents thus passing across the serous membrane without entering its cavity. We often meet with perforating ulcers of the digestive tube communicating with the solid viscera, as where the base of an ulcer of the colon is formed by the tissue of the kidney, and ulcers of the stomach resting on the spleen, or of the duodenum on the liver; in all these cases effusion into the abdominal canal is prevented—a cicatrix is formed, and the health of the individual preserved. In these cases circumscribed peritonitis only ensues, and they are generally the consequence of chronic disease, so that time is afforded for the exudation and organization of lymph.

This disease most frequently, however, occurs from a perforating ulcer of the lower portion of the ilium, consequent on acute disease. The following remarks of Louis are worthy of record: "The patients who have been the victims of this disease were young and vigorous, with the exception of the first, who was weak and of a lymphatic temperament; they had a good constitution, were rarely ill, not addicted to excess, and presenting a sanguine, a bilious, or a lymphatic sanguine temperament. Almost all had been but a short time in Paris. The causes of their disease were unknown. If we except a single case, it commenced as a slight, continued fever, and presented no severe symptom before the period of the perforation; in but one patient was there a severe diarrhœa, which was, however, of but short continuance; in another it had been moderate; still less in the subjects of the second and sixth cases, and not occurring in the remainder. Those with whom the diarrhœa was for a short time severe had slight pains in the epigastrium, and more severe pains in other portions of the abdomen, while in the remainder they were very slight, or not at all present before the period of perforation. Three of them believed themselves convalescent, and were considered so for some days, when the symptoms of this lesion occurred. A fourth seemed to have been cured rapidly of a slight enteritis; so that not only in these four subjects nothing occurred which could lead to the anticipation of the disease under which they sank, but it would have been absurd, from the mildness of their symptoms, to have apprehended any serious consequences; and at this moment we have before us the history of many patients who have died from an acute perforation of the intestine, and who, with this exception, presented no symptom which could distinguish them from analogous cases, where there was a rapid return to health. If the period of the formation of these ulcerations cannot be accurately determined, we shall scarcely be far from the truth in supposing that it coincides with the first symptoms of the disease, from which it would result that the progress of these ulcerations has been very rapid, and that they have arrived at their last period in from twelve to twenty five days, rarely later.

"At a certain period of the disease, on account of which the patients had entered the hospital, they experienced suddenly an exquisite and tearing pain of the abdomen, rapidly followed by alteration of the features, nausea, and vomitings, &c. These symptoms continued with greater or less violence from twenty to fifty-four hours, presenting remissions which were more or less well marked, and indicating a most intense peritonitis, produced by a violent cause acting in a hidden manner, just as occurs when an irritating substance is applied to the surface of the peritoneum. It is by the reunion of these signs that the lesion that now occupies us has been recognized by M.M. Lerminier, Chomel, and Martin Solon, under whose care the patients were. From these circumstances it appears that we may regard the following as characteristic signs of perforation of the intestine: *if in an acute disease, and in an unexpected manner, a violent pain of the abdomen suddenly supervenes, if this pain is exasperated by pressure accompanied by rapid alteration of the features, and more or less promptly followed by nausea and vomiting, we may believe and announce that there is a perforation of the intestine.*" (*Recherches Anatomico-Pathologiques*, Paris, 1826.)]

135. *c.* Certain causes occasion peritonitis through *the organic* and *vital actions*, and *the circulating fluids*, there being, however, a predisposition in the peritoneum, or some part of it, to become affected, or pre-existing circumstances determining the inflammatory action to this membrane. Many of the causes just enumerated may be merely determining influences in developing the morbid action in this situation, other causes affecting primarily the vital and circulating functions, and producing the inflammatory diathesis or constitution. Of these latter, the most frequent and influential are, exposure to cold, humidity, or both conjoined, and to currents of cold air; sleeping on the ground or in the open air, or in damp beds or bed-clothes; sitting in wet clothes; the contaminating or infecting influences of foul air, or of animal miasms upon injuries, wounds, &c., communicating either directly or indirectly with the peritoneum; the suppression of accustomed discharges or evacuations, and of determinations of blood from more external parts; the retropulsion of cutaneous eruptions, of rheumatism, erysipelas, &c.; repeated attacks of ague, occasioning vascular determinations to the liver and spleen, and unusual stretching of the investing peritoneum, favouring the supervention of inflammation of it; changes in the state of the blood, as respects both quantity and quality; and the puerperal states, and the various circumstances attending them. (*See* Puerperal Diseases.)

136. X. Treatment.—Having described the several states of local and general morbid action characterizing this malady, their varying consequences, and their complications, each of

which requires a different or modified plan of treatment, it becomes necessary that the means appropriate to each of them should be fully stated. In every case, however, the treatment ought to be conducted according to its individual features and circumstances; but in all, the measures should not only be efficient, but they should also be promptly employed, and with due reference to the stage and progress of the disease, and the other peculiarities of the case.

137. i. Treatment of Acute Peritonitis.—*A. Acute sthenic peritonitis*, whether partial or general, requires a prompt recourse to measures calculated, 1st, to arrest the inflammatory action locally, and the general febrile commotion; 2d, to prevent the most injurious consequences of inflammatory action from supervening, and to remove them, as much as may be possible, if already they have more or less taken place. These objects comprise all the indications which have been paraded by some writers, and which can rarely be individually followed or even mentally recognised in the course of practice; the intention being to take the shortest and most efficient method of accomplishing these ends. It should always be recollected, when treating this form of the disease, that, although most frequently commencing in a partial or limited form, it may rapidly become more and more extended, sometimes unexpectedly; and that the surest means of preventing this extension are active and prompt measures relatively to the constitutional powers of the patient.

138. *a. First. To arrest the morbid action*, whether more or less extensive, or of longer or shorter duration, the most antiphlogistic measures are required, and should be energetically employed, particularly in the more violent cases, and during an early stage of the disease, or before indications of much effusion into the peritoneal cavity, or of a very general extension of the disease, present themselves. In these latter circumstances the powers of life are often too far depressed by the extent and severity of the morbid action—the constitutional energy has sustained too severe a shock, at least in many instances—to admit of very active antiphlogistic means, or too copious depletions, especially at such an advanced stage of the disease as these changes characterize. During the earlier periods of this form of the malady, and particularly in young and robust or plethoric persons, *venesection* should be resorted to, in the manner so frequently recommended in this work (*see article* Blood, § 64, *et seq*), and blood taken until a marked impression is made upon the pulse, but short of fainting, for the reasons elsewhere assigned. Immediately after the depletion, full or even very large doses of *calomel* and *opium*—from five to fifteen, or even twenty, grains of the former; and from one and a half to three, or even four, of the latter—ought to be given. These will generally have the effect of allaying irritability of the stomach, of equalizing the circulation, of procuring perspiration or a relaxation of the skin, and of keeping down the vascular action to the point to which it was brought by the blood-letting.

139. If these effects are not produced in the course of a few hours, and more especially if the pulse still continue hard or constricted, and the abdomen tense and tender, or if the pulse should begin to rise, and the pain to increase or to return, *blood-letting* should be again practised, generally in smaller quantity, and be followed, as before, by a repetition of the calomel and opium, in the same, or in somewhat reduced doses, according to the effects produced by the former. In this disease, and more especially at an early period of it, the physician should not be deterred from blood-letting by the smallness of the pulse; for the pulse will become fuller and softer, and often less frequent, as the depletion proceeds. It may be necessary, in some cases, to repeat the blood-letting a third time in the manner already recommended, and to follow it by the calomel and opium as before; but in most instances of this form of the malady this will not be requisite, and in many, where a doubt may exist as to its propriety, leeches may be placed on the abdomen, in numbers according to the severity and other circumstances of the case; and be followed by fomentations, &c., and by calomel and opium, in doses suggested by the quantity and effects of those already taken, and by the period which has elapsed between the exhibition of them.

140. Having carried vascular depletion as far as may prudently be attempted, and having employed calomel and opium as now advised, the disease will be either entirely or partially subdued. If, however, pain, distention, and tenderness of the abdomen still remain—if the stomach be irritable, and the bowels constipated, the gums or tongue indicating no incipient mercurial action—the calomel and opium may be again exhibited in quantities suggested by circumstances, and several folds of flannel should be wrung as dry as possible out of very hot water and freely sprinkled with spirits of turpentine, and placed over the abdomen, and covered by oiled silk or by napkins, so as to confine the terebinthinate fumes as much as possible to the part. This *fomentation* ought to be applied as long as it can be endured, and even be repeated in many cases. The admirable effects of it have been proved to me on many occasions at this stage of the malady, both before and since I wrote in favour of it in 1821. (*See a Memoir on Terebinthinate Remedies in Disease*, in Lond. Med. and Physical Journ., vol. xlvi., p. 107, 185.)

141. The usual effects of this application, after the measures advised to precede it have been duly employed, are a diminution of the abdominal pain, distention and tenderness, and of the irritability of the stomach; a reduction of the frequency of the pulse, which becomes fuller and softer; and a general diffusion of heat, usually with perspiration over the surface and extremities.

142. *b.* It is possible still that the above energetic means may fail, both in arresting the progress of the malady and in affecting the gums and tongue in the way which is desired. It should, however, be recollected that many cases will proceed favourably, and to complete resolution, without any mercurial effect upon these parts; but when such effect begins to appear, it should be viewed as a favourable indication, and the calomel should either be relinquished or much reduced in quantity, as this effect may rapidly increase. If, however, neither of these beneficial influences appears to

follow, depletions being no longer admissible, and the terebinthinate embrocation having also failed, a *blister*, or the vesicating fluids recently introduced, may be applied over the abdomen, and vesication be promoted by a warm bread-and-water poultice. Afterward, the cuticle should be removed, if the symptoms persist, and mercurial ointment be applied, either on the surface of a poultice or in the usual way. The object in thus persisting in the use of *mercurials*, as now proposed, is not only to aid in arresting the inflammatory action, but also to prevent the more serious of those consequences, namely, albuminous exudations and serous effusions, which frequently result. They should be exhibited from the commencement of treatment, in full, or in frequently repeated doses, conjoined with opium, so as to aid the blood-letting in making an early and energetic impression on the disease, and not be delayed until an advanced period.

143. I have been called to cases where blood-letting has been pushed too far, with the mistaken idea that the frequency of the pulse is to be reduced by it. But, although this effect is often observed when blood-letting has an immediate influence on the disease, and in healthy or robust persons, yet in other circumstances, particularly in weak, or nervous, or irritable constitutions, the pulse will more frequently become quicker, and even sharper, from the repetition of it.

144. *B.* There are *three symptoms* which often increase the difficulty of treating peritonitis and augment the severity of the disease, and which are often aggravated by the mode of treating them. These are the irritability of the stomach, the constipation, and the flatulent distention of the bowels. To each of these I advert.—*a.* The *sickness* and *retchings* at an early stage of the malady are best encountered by calomel and opium as above advised, and by turpentine fomentations, after bleeding has been duly resorted to, aided in some cases by *creasote* conjoined with the calomel and opium, or by *hydrocyanic acid.* The attempts to allay this symptom by effervescing draughts are generally futile, for the stomach readily reacts upon the distention caused by these draughts and throws off the ingesta. Neither ought much fluid or cold fluids to be given; the mouth and throat should be merely rinsed with tepid fluids, or small quantities of them only be sipped. The retchings or pumping up of the contents of the stomach, characterizing a fatal issue in extreme cases, and often associated with singultus, will not be removed, and seldom even alleviated by any means whatever.

145. *b. Constipation* is frequently removed, even when most obstinate, by the treatment I have advised, without having recourse to purgatives. I have often seen much mischief result from the officious interference of the practitioner in these cases; the irritability of the stomach and the severity of the disease being heightened by repeated endeavours to operate on the bowels by drastic purgatives given by the mouth. It is best, at an early stage of the disease, to wait the effects of the treatment advised above for a reasonable period, and then to have recourse to *cnemata* containing spirits of turpentine, with castor or olive oil, or with both, in a thick decoction of barley. These may be repeated from time to time, until the bowels are sufficiently evacuated, without any dread of the complaint being aggravated either by their frequency or the amount of the ingredients. At a somewhat advanced period of the disease, particularly when the irritability of the stomach has been removed by the calomel and opium, and much flatulent distention of the bowels still continues, from two or three drachms, or half an ounce, to six drachms each of spirits of turpentine and castor oil may be taken on the surface of milk or peppermint water, and repeated according to circumstances. I have often seen this medicine productive of great advantage; and, at a still more advanced stage of the malady, it has remained on the stomach, although vomitings, unattended by effort or by retchings, were present, and every thing besides was instantly rejected.

146. *c. Flatulent distention* of the abdomen may continue, and perpetuate pain and tenderness after inflammatory action has been removed or much reduced. In these cases the flatulence is the result chiefly of the lost tone or contractility of the coats of the bowels; and the distention by gaseous fluids of the tender and inflamed peritoneum, or of the peritoneum independently of inflammation, develops the sensibility of this tissue, and indicates a greater amount, or a longer persistence, of inflammation than actually obtains. A recurrence to blood-letting in any form in such circumstances, which, as I have had reason to know, is not an infrequent practice, and was formerly much more so, is generally most injurious. The good effects of *terebinthinate enemata* and *embrocations* in these circumstances are almost always remarkable, and are still more so when the spirits of turpentine are taken internally, either as just advised or in other forms, in which I have so often prescribed this medicine and recommended it in the course of this work.

147. *d.* It was advised by the late Dr. Sutton of Greenwich, and by some German physicians, by whom I have seen many years ago the practice adopted, to apply *cold* or *evaporating lotions*, or *ice*, to the abdomen in peritonitis. If the practice is admissible at all, it is in this form of the disease, and at an early stage of it, that it should be employed. My recollections of it are not, however, such as would induce me to recommend it, while my experience of the practice I have prescribed above has been so long and extensive as to fully warrant my commendations. Dr. Symonds, however, remarks that, in some cases, cold evaporating lotions have seemed preferable to other applications, the evaporation being accelerated by blowing the surface by a common bellows; and that he has placed the patient in a warm bath, sufficiently long and shallow for him to lie extended, and for the tumid abdomen to rise above the level, so that a jet of cold water could be poured upon the latter. "The relief," he adds, "has been most striking, even when the disease was too far advanced for a cure." (*Op. Cit.*, p. 145.)

148. *e.* When the disease yields, as it usually does, to the above means, when early employed, and the indications of resolution appear, little more is requisite than attention to the state of the secretions and excretions, which should be promoted by gentle alteratives and

aperients, aided by an occasional recourse to oleaginous or emollient enemata. As the pulse usually continues frequent for some time after the other symptoms subside, owing to loss of blood and debility, this circumstance should neither create alarm nor lead to an officious or unnecessary interference. A premature recourse to tonics or stimulants, or to an exciting diet or heating regimen, would be injurious, and lowering measures, on the other hand, would only protract convalescence. In this state mild diaphoretics and diuretics, as the camphor mixture, with the liquor ammoniæ acetatis and spiritus ætheris nitrici, will generally prove both safe and beneficial; while the functions of the skin should be promoted by warm baths, by warm clothing, by flannel worn next the skin, and by avoiding the exciting causes. The lower extremities should always be kept warm; and the bowels and urinary functions ought to receive the strictest attention long after the patient has recovered.

149. *C. The second object*, namely, *to prevent the injurious consequences of peritonitis, and to remove such as may have been already produced*, is best accomplished by a prompt and judicious recourse to the measures already recommended. But the physician may have been called too late to prevent these consequences; the disease may have advanced to that stage at which one or other of the more unfavourable results described above (§ 33, *et seq.*) has either supervened or is in progress. If *effusion* have taken place, or is even proceeding, *blood-letting* in any form may be of little use, or even injurious. Still, it may be practised with due caution while the pulse retains some power and is not very frequent, and when the patient is young, and his vital powers not remarkably depressed. In similar circumstances, also, *calomel* and *opium* may be prescribed and repeated from time to time; although, at this late period of the malady, the mercurial effect on the system may not be readily, or even at all, produced. A few grains of *camphor*, added to the calomel and opium, will often be of service in these cases. The *terebinthinate fomentation* over the abdomen, and terebinthinate *enemata*, a terebinthinate draught, also, being occasionally given, are most important measures in these circumstances, whatever may be the amount or the exact nature of the lesions produced by the inflammation. *Vesicatories*, followed by poultices, with or without mercurial ointment, as circumstances indicate, may be applied to the abdomen, as above advised (§ 142); but they require discrimination, especially as to the period of their application. In most instances they should be large and efficient. In some cases a prolonged discharge from them may be procured in the usual way; and, when the gums have not been affected by the mercurials previously given, the application of mercurial ointment to their surfaces, the cuticle being removed, will often produce a local and constitutional effect. In other cases a repetition of blisters may be requisite, while *mercurial alteratives* and *aperients*, as Plummer's pill with soap, the bi-borate of soda with the watery extract of aloes, &c., and *oleaginous or emollient enemata*, are being employed. In some instances, especially when much liquid effusion has taken place in the peritoneal cavity, I have directed the following embrocation, sprinkled on two or three folds of flannel, to be applied over the abdomen, and kept there for a considerable time, or even worn for some days, when the amount of irritation produced by it admits of its continued application. In other circumstances a repeated recourse to it should be insisted on:

No. 307. ℞ Linimenti Camphoræ comp.: Linimenti Terebinth.; Olei Olivæ, āā, ℥jss; Olei Cajuputi, ℥jss. M. Fiat Embrocatio vel Linimentum.

When the physician is called late in the disease to a case of acute peritonitis, it is prone to pass into the chronic state; and this may be the most favourable result which can be anticipated from the extent of lesion already produced. In these instances the treatment about to be mentioned as appropriate to the chronic disease is in many respects the same as that now advised, and should be resorted to, taking care, however, not to reduce the powers of life so low as to render them unable to resist the extension of the morbid changes.

150. *D.* The *treatment of acute asthenic peritonitis* (§ 26) is rarely entered upon with any hopes of advantage, unless at the commencement, or at an early stage of the malady; and then the most energetic means are required to arrest its progress, and even they will frequently fail if they be not employed with discrimination, the extension and course of the disease being extremely rapid, and effusion quickly supervening. This form of peritonitis occurs most frequently in the puerperal state, both sporadically and epidemically, and especially in lying-in hospitals, where it often spreads throughout the wards (*see* Puerperal Diseases). Instances, however, of this form of peritonitis are observed in other circumstances, especially in connexion with erysipelas, and with other maladies already alluded to (§ 26). In these the chief object is to arrest the extension of the morbid action by those remedies which will make the most powerful impression, and in the shortest period, upon the organic nervous and vascular systems: an impression which shall enable these systems, at the same time, to resist the extension of the local mischief, and to remove the changes which have already taken place. After having made trial of various remedies and methods of cure in this form of the disease, the means which I have had reason to confide in are, a combination of *camphor*, *calomel*, and *opium* in large doses, repeated every four, five, or six hours, according to the features of the case; in some instances *sulphate of quinine*, camphor, and opium in frequent doses; *epithems* or *fomentations of warm spirits of turpentine* over the abdomen, renewed or repeated according to circumstances; *terebinthinate enemata*, and occasional doses of *spirits of turpentine* by the mouth, with or without *castor-oil*, or other medicines. I have employed this treatment since 1823, modifying it with the peculiarities of individual cases; but it is more fully described in the article on the several forms of *fever* and of *peritonitis in the puerperal state*. (*See* Puerperal Diseases.)

151. *E. Peritonitis from perforation of the stomach or intestines* may assume various forms, according to the circumstances under which the perforation occurs.—*a.* As I have shown above

(§ 27), if it result from chronic ulceration of any portion of the digestive canal, it may be limited to that portion of the membrane more immediately surrounding the perforation; and, coagulable lymph having been effused, that part becomes agglutinated to the opposite surface, and effusion of the contents of the canal into the peritoneal cavity is thereby prevented. In this case the symptoms only of *partial peritonitis* are manifested, and the disease may assume an acute, sub-acute, or chronic character. An instance occurred in my practice of a female who lived between two and three years after peritoneal symptoms, caused by ulceration and perforation of the stomach, appeared; she was treated chiefly by *opiates*, and upon dissection the peritoneum, for a considerable space around the large perforation, was thickened, adherent to the opposite surface, and almost cartilaginous. (*See art.* Stomach.)

152. *b.* In many cases, however, especially when the perforation takes place in the course of continued or exanthematous fevers, and of phthisis, the constitutional powers and the state of the circulating fluids are such as generally admit not of the production of coagulable lymph, and the formation of adhesions between the opposite peritoneal surfaces. In these circumstances, a portion of the contents of the digestive canal escapes into the peritoneal cavity, occasioning a rapid form of *general asthenic peritonitis*. Sometimes, however, the disease continues for a time more or less limited, acute pain and tenderness being confined chiefly to the region in which they were first experienced. In this case some hopes may be anticipated from treatment. Dr. Graves and Dr. Stokes first suggested the most rational principle and means of cure in this state, namely, to enable the constitution to produce coagulable lymph, by which the opposite surfaces of the peritoneum may become adherent, and to keep the bowels quiescent until this end be attained. The most efficient means to accomplish these intentions are, frequent and full doses of *opium*, and the remedial, dietetic, and regimenal measures usually employed to promote the strength of the patient, accommodated variously, so as to suit the peculiarities of particular cases.

153. *E. Peritonitis consequent upon paracentesis abdominis*, or other operations, especially if there be any connexion between it and erysipelas (§ 28), generally assumes the asthenic form, and should be treated upon the principle of enabling the constitution to form coagulable lymph, and of assisting the powers of life to resist the extension of the malady. With these views, *opium*, in full and frequent doses, should be given, and the usual remedial and dietetic means of supporting the vital powers ought to be employed. In short, the treatment advised above (§ 150) should be adopted, and modified so as to meet the exigencies of each case.

154. ii. Treatment of Chronic Peritonitis. —*A.* In a few cases only of the *general* and *tubercular forms* of the disease can it be hoped that very great advantage will be procured from treatment. Much, however, may be done in alleviating the more unpleasant symptoms, especially the attendant diarrhœa, and even in prolonging the life of the patient. In some cases, particularly where the powers of the patient are not much reduced, *local depletions*, by means of leeches, repeated as circumstances will suggest, will be of considerable service; but venesection can rarely be attempted. I have found most benefit to be derived from the *turpentine liniment* or *embrocation* recommended above (§ 140), with the addition of a little of the *iodide of potassium* and *vinum opii*. It should be perseveringly used, and be aided, particularly when there is much liquid effusion, by the *iodide of potassium* given internally with *opium*, or with the *compound tincture of camphor* and *sarsaparilla*. *Opiates* are indispensable in most instances, and more especially when the bowels are much relaxed. They may be given as just recommended, or alone, or with absorbents, mucilages, and emollients. I have employed the iodide of potassium in this disease since 1824, but it is most beneficial when taken in very small doses, and when long persevered in. Even in moderate doses it is prone to develop an acute state of peritonitis; and in this case the application of leeches, of turpentine fomentations with opium, &c., to the abdomen is indispensable, in order to subdue the acute or sub-acute action thus produced, the iodide being relinquished.

155. *B. Partial chronic peritonitis*, existing either simply, or associated with chronic visceral disease, is often either permanently removed or reduced to a state which is inconsistent with the performance of the functions, even of that organ, the peritoneal surface of which has been more or less implicated. The disease may degenerate into adhesions of a loose or cellular kind, which may not interrupt materially the offices of the connected organs. Still, these adhesions may excite farther change, may occasion inflammation, or may themselves be the seat of it. It is not infrequently observed that inflammation of a viscus covered by the peritoneum extends to this membrane, or the inflammation may commence in and be limited to a portion of the peritoneum in an acute or sub-acute form, and, being either neglected or only partially removed, continues for an indefinite time afterward in a chronic state. In this case, attention to the functions of the organ affected or consecutively implicated, the occasional application of a few *leeches* when pain or tenderness are felt, followed by warm *fomentations* or the *terebinthinate embrocation*; by *opiates* with *alteratives*, cooling *diaphoretics*, and *diuretics*, and such other means as the seat, severity, and associations of the disease will suggest, are the means upon which the chief dependence should be placed. In some instances of this partial state of chronic peritonitis, the *iodide of potassium*, or the *iodide of mercury*, in small doses, may be tried subsequently to a due recourse to the means just mentioned, with the view of reducing adhesions; but the effect should be carefully observed. Partial chronic peritonitis is most frequently observed in the peritoneal coverings of the spleen, liver, and female sexual organs, as a consequence of inflammation of the subjacent viscera, and is there more readily removed by treatment than in other situations; or, at least, is more easily reduced to a state of comparative innocuousness.

156. iii. The Complications of Peritonitis require attention in both the *acute* and *chronic*

states of this disease. It is chiefly, however, in the partial forms of peritonitis, or early in the more general malady, that these complications become objects of the greatest importance. In every case it is necessary to ascertain, as far as may be, the organ or part primarily affected, and the extent of the superinduced disease; for in many the primary malady will perpetuate the consecutive affection of the peritoneum —*a.* When *hepatitis* extends to the peritoneum covering the convex or the concave surface of the liver, the portions of the membrane reflected over the diaphragm in the one case, and over the stomach, colon, and duodenum, &c., in the other, are often implicated (§ 71–74). The disease may even extend farther, not merely as regards the peritoneum, but as respects other parts. Thus I have seen diaphragmatitis, pleuritis, and ultimately pleura-pneumonia, follow hepatitis, on the one hand, and partial or even general peritonitis supervene on the other. In these circumstances, and especially before the disease has thus extended, every effort should be made to bring the system under the influence of mercury as soon as possible, while at the same time the constitutional powers should be aided in resisting the farther extension of the malady. In addition, therefore, to judicious vascular depletions, calomel, camphor, and opium should be exhibited as above advised (§ 139, *et seq.*), and be aided by terebinthinate fomentations and enemata.

157. *b. The association of peritonitis with inflammation of the cæcum*, or of the *appendix cæci* (§ 74), is one of the most frequent and important which comes before the physician. In many instances, as I have shown in the article Cæcum, the impaction of a hard body into the *appendix* perpetuates the inflammation of it, as well as of the peritoneum, and prevents a favourable result, however judicious the treatment may be. When the partial peritonitis caused by the disease of the Cæcum (see that art., § 18–20) is acute, the treatment already recommended (§ 138. *et seq.*) for simple sthenic peritonitis, or that advised above for the complication with hepatitis, should be adopted. I may refer the reader, also, to the treatment recommended by me for inflammation extending to the peritoneum, in the article Cæcum (§ 32). In the more *chronic state* of this association, the means already prescribed for partial chronic peritonitis (§ 155) may be adopted, due attention being paid to the secreting and excreting functions of the liver and bowels.

158. *c.* The *associations of enteritis, and of acute or chronic dysentery with partial peritonitis*, are very common (§ 74); and even in general peritonitis, both the small and large intestines are often more or less affected. These complications are generally the most difficult to manage; for, if the bowels be obstinately constipated, attempts to move them by drastic purgatives frequently aggravate the disease. The treatment in this case should be directed almost entirely to the inflammation, and consist of those means which I have advised for the sthenic form of it (§ 140, *et seq.*), aided by suitable enemata. When the inflammation has been allayed, and the bowels still remain confined, such mild laxatives as may solicit, rather than force, the action of the bowels, only ought to be employed. On the other hand, if the bowels are much relaxed, or if diarrhœa or a dysenteric state be present, the arrest of the increased discharge from the mucous surface of the bowels may increase the morbid action in the peritoneum, while the persistence of the diarrhœa may arise from ulceration, which has either already caused, or will aggravate, the peritonitis. The early history of cases of this kind is the chief guide of the physician, aided by the extent and severity of the peritoneal symptoms. If the diarrhœa be merely an attendant on the peritonitis, as it sometimes is in the asthenic form of the disease, attempts ought not to be made to arrest, or even to moderate it, unless it be excessive, and exhaust the patient; whereas, if the peritonitis, in any form, supervene on diarrhœa or upon dysentery, the persistence of the latter, whether ulceration or perforation exist or not, will aggravate the peritonitis; and, therefore, while the chief attention ought to be directed to it, strenuous efforts should also be made to moderate or remove the disorder of the bowels. In the first case, the bowel affection depends upon the peritonitis, and the treatment, as I have advised, should be directed with promptitude and activity to this latter—to the primary and chief disease. In the second case, the disorder of the bowels has not merely caused, but still continues to perpetuate and to aggravate the peritonitis, and ought, therefore, to be moderated or controlled even where it might not be prudent at once to arrest it, supposing this to be in our power. In this complication, whatever may be the sequence of morbid action, an extensive experience has proved to me that the terebinthinate remedies, used both internally and externally, are most to be depended upon when judiciously prescribed. That the right use may not be made of them, in respect both of the circumstances and period of the disease in which they should be used, and the modes of exhibiting and combining them, and hence that they will sometimes disappoint many who may have recourse to them, I can fully believe. But in these contingencies they participate with all our other most efficacious remedies. Opium, with ipecacuanha in large doses, when the bowels are much disordered; appropriate enemata, and other means already noticed, adapted or combined so as to meet the exigencies of particular cases, are also important adjuvants in the treatment of these complications.

159. *d. The association of peritonitis with inflammation, or with organic lesions of the urinary and sexual organs* (§ 75), is not infrequent, especially among females, and in the puerperal state. In ordinary circumstances the associated peritonitis is generally consequent upon the visceral disease, and is commonly partial, unless in puerperal or cachectic states, or in the course of fevers, where it often rapidly becomes more or less general. It sometimes, also, passes into a chronic form, especially when it is consecutive of organic lesions, or is independent of the puerperal condition. In these several associations the treatment should partly depend upon the extent of the peritoneal affection, and upon the degree of vital power characterizing the disease. When the asthenic and diffusive form is present, the treatment advised above is most appropriate (§ 150); but when the more sthenic

and partial or limited state of morbid action exists, then the means already recommended (§ 140) are those which are most beneficial for this state of complication. In either case the peritonitic disease claims the more immediate and the chief attention, as upon the limitation or extension of it depends the recovery or the loss of the patient. It being arrested, or more or less subdued, the treatment should be more strictly directed to the primary lesion of the sexual organs; and the functions of these organs ought to be promoted, especially as respects the menstrual discharge. Even after the disease is apparently subdued by the vascular depletions, &c., prescribed above, still pain or tenderness often recurs, especially about the expected catamenial period, and is sometimes attended by scanty or difficult discharge. In such cases leeches should be applied below each groin, and be followed by fomentations, as already advised (§ 140), by small doses of the biborate of soda in camphor and orange-flower water, and by such other means as the peculiarities of individual cases will suggest.

160. iv. Treatment of Peritonitis in Children.—*A.* The principles of treatment which I have advocated for adults are also applicable to children. In the latter class of subjects, however, *acute peritonitis* generally assumes a *sthenic* or phlogistic character, unless when it follows eruptive fevers or mesenteric disease, when a subacute and diffusive state is often assumed, not infrequently lapsing into the chronic form, particularly in the scrofulous diathesis. In the more sthenic of these states of disease, local depletions, calomel, terebinthinate fomentations and injections, emollient warm baths, with the other means already advised, according to the circumstances of the case, are the measures upon which our dependence ought to be chiefly placed. When peritonitis follows the maladies just mentioned—when it presents, either locally or as regards the constitutional symptoms, the asthenic, diffusive, or subacute state—calomel with camphor, and with opium in small doses, when the age of the patient will admit of this last, and terebinthinate remedies in the several forms already prescribed, and duly repeated or continued, are the principal means of cure.

161. *B.* If the disease pass into the *chronic state*, or assume this form primarily—if it be *tubercular*, as it most frequently is, or *simple*, and attended by fluid effusion into the peritoneal cavity—a cautious recourse to *iodine*, especially to the proto-iodide of mercury, to the iodide of potassium, with liquor potassæ and sarsaparilla, and a frequent or continued use of the terebinthinate embrocation over the abdomen, as above advised (§ 140, 141), either with or without the iodides externally, should in no case be neglected; but they should be perseveringly employed, and the iodides ought to be given only in very small doses, especially at first, and be aided by change of air, and exposure to light and sunshine. When chronic peritonitis is attended in children by diarrhœa, when it is far advanced, and its tubercular nature manifest, then ulceration, or, at least, a state of lesion almost precluding hope, may be inferred. Our treatment should then be directed to the alleviation of urgent symptoms; to the moderation of the attendant diarrhœa and pain by means of absorbents and opiates, by hydrarg. cum creta with compound ipecacuanha powder, and warm baths, or fomentations over the abdomen.

162. v. Convalescence *from any of the forms of peritonitis* requires the utmost care and caution, especially in respect of *diet* and *regimen*. During the continuance of the disease, particularly in the acute form, bland or emollient fluids only should be allowed. The compound decoction of barley may be taken in small quantities; and, when a relaxing effect upon the bowels is desired, then about a drachm of oleum olivæ may be given on its surface three or four times in the day, or oftener. In the acute state of the disease, this, or simple barley, rice, gum-water, rendered agreeable with loquorice powder, is all that is required, both as drink and as aliment. In the chronic states, however, or during the early stage of the convalescence from the acute, the same watery decoctions, with small quantities of ass's or other milk [rennet whey], or weak arrow-root, or other farinaceous substances, may be allowed; and, subsequently, according to the progress of the case or the amount of debility, mutton, or veal, or chicken broths, or beef-tea, in small quantity, with dry toast, or with boiled rice or stale bread, may be cautiously permitted. The greatest caution should be used in returning to animal food; and that which is the mildest, least stimulating, and most digestible only should be allowed, in small quantity, once in the day. All heating or stimulating beverages, and flatulent or ascescent vegetables, ought to be avoided. Chocolate or cocoa-nibs should be substituted for tea and coffee; and, in the case of infants or children, ass milk warm from the animal, either pure or diluted, is one of the best articles of food, as well of drink, that can be administered.

163. During the course of, as well as convalescence from, this disease, a perspirable state of the surface ought to be preserved by flannel worn constantly next to the skin, by warm baths rendered emollient by an alkali, by decoction of marsh-mallows, or infusion of linseed, &c. If the bowels, after recovery, continue irregular or constipated, the emollient decoctions or infusions may be employed as enemata, to which oleum ricini or oleum olivæ may be added; and small doses of these, particularly of the latter, may be taken frequently, on the surface of any suitable diluent or demulcent, until a regular action shall be established.

XI. Organic Lesions of the Peritoneum, independent of Inflammation.

Classif.—IV. Class, I. Order (*Author*).

164. i. Description.—The lesions of the peritoneum which have already been noticed have chiefly been those which are consequent upon inflammation in some one or other of its several forms or types. Tubercular formations are, however, an exception; and these have been noticed only incidentally, and in as far as they are associated with chronic peritonitis, particularly in scrofulous constitutions. A brief notice only will be taken of those changes which are not essentially caused by inflammation, as they are generally, especially in the circumstances in which they usually present themselves, but little influenced by medical treatment. Certain of these changes affect rather the attached surface, or the sub-peritoneal tis-

sue, than the peritoneum itself; while others consist in the presence of fluids altogether foreign to the peritoneal cavity.

165. *A. Various changes of colour* are occasionally presented by the peritoneum, which are independent of inflammation. — *a. Yellowish* or even *greenish tints* are sometimes observed in those parts of the membrane in the more immediate vicinity of the gall-bladder, and are owing to the exudation of bile. The extent and the intensity of the colour generally depend upon the colour and quantity of bile contained in the gall-bladder and ducts, and upon the duration of the period from the death of the patient. Various shades of colour are often observed in the peritoneal surfaces of the liver and spleen, and are generally owing, when they are very deep or dark, bluish or brownish, to venous congestion of these organs, or to accumulations of black viscid bile in the hepatic ducts. These deep shades of colour are most remarkable in warm climates, after hepatic, periodic, and other fevers.—*b.* The peritoneum may also present a *reddish hue* without having been inflamed. This always is owing to the escape of blood, from accident or rupture of vessels, into the peritoneal cavity; and hence its nature is apparent. It is always a *post-mortem* change.

166. *B. The sub-peritoneal cellular tissue* is not infrequently the seat of various changes, which, although sometimes connected with, is oftener independent of, inflammatory action.—*a. Œdema* of this tissue is occasionally observed in consequence of chronic disease of the heart, liver, lungs, or kidneys; and is most conspicuous in those situations where the cellular tissue is most abundant and loose; as in the vicinity of the pancreas, kidneys, and sexual organs.

167. *b.* Minute transparent *vesicles*, varying from the size of a millet-seed to that of a pea, or even of a marble. They occur most frequently about the Fallopian tubes, ovaries, and broad ligaments. *Serous cysts* are not infrequently found between the folds of the broad ligaments, and sometimes attain the size of a large orange, simulating ovarian disease, and constituting one of the forms of encysted dropsy. (*See art.* Dropsy, § 206, 212.)

168. *c. Tubercles* and *scrofulous tumours* are the most frequent and important organic lesions primarily occurring in the sub-peritoneal cellular tissue independently of inflammation, although, with all other morbid formations in the same situation, generally inducing chronic inflammatory action in their progress. Scrofulous tubercles in this situation, and when well defined, seem to be encysted, owing to the condensation of the cellular tissue directly investing them. Dr. Hodgkin states, that these scrofulous tubercles or tumours are most frequently seen, and are the largest, between the folds of the mesentery; but they obviously implicate the glands in that situation. They also attain a considerable size in the omentum. Under the peritoneal coat of the intestines they are generally small, but numerous. Dr. Hodgkin considers the small miliary granulations, which I have described above (§ 107), as consequences of inflammatory action, and which are found, both below and in the peritoneum, to be incipient tubercles. I have already endeavoured to distinguish between those granulations which seem to result from chronic inflammation and scrofulous tubercles.

169. *C.—a. Malignant deposites, or formations* of a *scirrhous* or *fungoid character*, occur occasionally on the attached surface of the peritoneum, and sometimes they extend from the subjacent structures, and invade this membrane. Dr. Hodgkin remarks, that in the former case the tumours which result are often remarkable for their size, number, and diffusion; but that, even in these, some portions of the peritoneum more frequently escape than others. Thus, these morbid growths are not so often met with on the parietes as in the omentum, or in the intestines; and, when formed in the parietes, they are generally of a smaller size. Neither the mesenteric glands nor the other organs invested by the peritoneum are apt to become affected by the extension of the disease. These growths are sometimes, although not necessarily, attended by serous effusion into the peritoneal cavity, causing distention, which is occasionally very considerable. When the disease is propagated from the primarily affected organ, it is generally to the vicinity only; thus, in scirrhus of the pylorus, a sprinkling of minute scirrhous tubercles is often seen under the peritoneum in the neighbourhood; and in malignant disease of the uterus, the convolutions of the intestines which happen to come in contact with it often exhibit growths of a corresponding character beneath their peritoneal coat.

170. *b.* The *free* or *internal surface* of the peritoneum is very rarely the seat of malignant growths. Dr. Hodgkin, however, met with two instances in which it was the seat of these growths; but in these, malignant formations also were found in organs invested by this membrane, and were manifestly developed primarily in these organs. In one case, in addition to fungoid disease of the kidney, there were small malignant tubercles situated in and beneath the peritoneum, and others seated on the free surface of it; and in the other case these tubercles were scattered beneath the peritoneal coat of the intestines, and on its free surface, the chief and primary fungoid tumour being in one of the ovaries.

171. *c. Melanosis*, also, is sometimes met with, invading, rather than primarily affecting, the peritoneum; and it is chiefly observed on the attached surface of the membrane, to which it has extended from the subjacent structures and cellular tissue; where, however, it presents the usual characters assigned it when treating of it elsewhere. (*See art.* Melanosis.)

172. Although scrofulous tubercles and scirrhous and fungoid productions affect the peritoneum independently of inflammation, and appear in those circumstances, and from causes which are fully developed in the articles devoted to those several subjects, still they not infrequently are found accompanied with more or less abundant effusion of serum, and with bridles, or films of adhesion, indicating, the latter especially, that a chronic form of inflammatory action had been excited by their presence and in their vicinity.

173 *D. True hydatids* or *acephalocysts* are sometimes produced beneath the peritoneum, and occasionally they attain a very large size so as to resemble encysted dropsy, from which

they are with difficulty distinguished during the life of the patient, especially when they form between the folds of the broad ligaments of the uterus. They are met with chiefly under the peritoneal covering of the liver, beneath that of the spleen, in the broad ligaments, and in the mesentery; but the first is their most frequent seat. They may burst into the peritoneal cavity without producing any signs of inflammatory action; but a chronic and limited state of inflammation may be occasioned by them. In either of these situations they may pass through those changes which have been described when treating of them. (*See article* Hydatids, § 15–25.)

174. *E. Ecchymoses* and small *bloody points* are occasionally found in the peritoneum, owing to minute extravasation of blood, caused by diminution of the tone of the capillaries and of the vital cohesion of the sub-peritoneal tissue, and probably, also, of the peritoneum itself. They are most frequently observed under and in the peritoneal coat of the small intestines, but are also sometimes met with in other situations. They occur chiefly in purpura hæmorrhagica, in adynamic fevers, and in scurvy, in which last I have observed the ecchymoses assume the form of vibices, or patches, as large as half-crown pieces. Dr. Hodgkin remarks, that he has seen the peritoneum sprinkled with small bloody points, not only in purpura, but also in jaundice.

175. *F. Various substances foreign to this situation are sometimes found within the peritoneal cavity.—a.* The most common is an accumulation of *serous fluid.* This fluid may result from increased exhalation of serum, arising from congestion, or impeded return of blood from the abdominal viscera, consequent upon disease of the liver, heart, lungs, kidneys, &c. In these circumstances, the effused fluid contains comparatively but little albumen; and when this is the case, and the more watery and limpid the effusion, the less prone the peritoneum is to be irritated or inflamed by it. Still, a state of chronic inflammatory action is sometimes induced by the state and quantity of the effused fluid, affecting chiefly the omentum and mesentery, and occasioning more or less shrinking of these parts. The disposition, also, to chronic, or even to acute asthenic peritonitis, occasioned by serous effusion into the peritoneal cavity, is further evinced by the frequency of its supervention upon *paracentesis abdominis.* It has been stated above (§ 101, 102) that the effusion of fluid into this cavity consequent upon inflammatory action is often very great; but in this case, whatever may be the form of inflammatory action producing it, the fluid contains more or less albumen, occasionally, also, blood globules or colouring matter, and even pure or dissolved blood, although much more rarely; and the peritoneum is altered in structure, or it presents other morbid products.

176. *b. Blood*, fluid or coagulated, recent or partially altered, pure or mixed with serum, &c., is in rare cases found in this cavity; but generally in consequence of rupture of some one or other of the invested organs, or of an aneurism. Broussais contended that it is sometimes effused in considerable quantity, owing to a hæmorrhagic peritonitis, or to a state of action partaking of both an inflammatory and a hæmorrhagic character. This may be probably the case, but on rare occasions. Hæmorrhage may also occur into this cavity to a considerable extent, owing to the ulceration attending some states of chronic peritonitis, of which I have met with a remarkable instance. When blood is effused into the cavity owing to wounds, injuries, &c., it always rapidly produces inflammatory action, which is followed by the effusion of coagulable lymph, if the powers of the constitution are not remarkably depressed; and this lymph may limit or surround the blood effused, and thus in some respects isolate or encyst it, and thereby even confine and ultimately repair the mischief. The effused lymph, by subsequently becoming organized in the manner described (§ 82–84), may even give rise to various changes in the blood surrounded by it, similar to those remarked in coagula found some time after extravasation into the parenchyma of organs.

177. A partially decomposed blood, mixed with more or less serum, or a sanious fluid, is in rare instances found in the peritoneal cavity unconnected with inflammation, and chiefly in the same circumstances and in the same cases as have presented ecchymoses of the peritoneum. This state of the effused fluid I have seen only in scurvy, purpura, adynamic fevers, malignant puerperal fever, and malignant smallpox; and in these circumstances the sanious or bloody state of the effusion, as well as the ecchymoses, is owing as much to alteration of the blood as to the impaired vital cohesion of the peritoneal surface and capillaries.

178. *c. Chyle*, *bile*, *urine*, and even the *amniotic fluid*, have been found in the peritoneal cavity, but only in consequence of wounds and injuries of the peritoneum and parts involving the vessels concerned in transmitting, or the organs containing, these fluids. Rupture of the fundus of the urinary bladder, or of the uterus, is necessarily followed by the escape of the contents of these organs into the peritoneal cavity. *Purulent matter* is sometimes found in this cavity independently of inflammation of the membrane, owing to the bursting of an abscess, especially of that of the liver. *Tubercular matter* is in rare instances found in this situation, owing to perforation of the peritoneum, particularly after scrofulous or tuberculous disease of the mesenteric glands, and in chronic tubercular peritonitis. The *alimentary*, *fæcal*, or *gaseous* contents of the *stomach* or the *intestines* occasionally escape into the peritoneal cavity, and even *intestinal worms* are also, in rare cases, found there, owing to perforation of these viscera, either no adhesions, or partial adhesions only, having existed between the opposite peritoneal surfaces adjoining the perforation. In all cases of the passage of these foreign substances into the peritoneal cavity peritonitis is quickly induced, and extends with a rapidity co-ordinate with the acridity, quantity, and diffusion of the foreign substance and the susceptibility of the patient.

179. *d.* It has been shown above (§ 119) that *gases* are sometimes found in the peritoneal cavity, causing more or less true peritoneal *tympanitis* or *meteorismus*, owing to the partial decomposition of a portion of the products of inflammation, especially when these products

are long retained. This source of the gases sometimes found in this cavity is now generally admitted by pathologists. But it has been supposed—been contended for by some and denied by others—that air may be secreted on the free surface of the peritoneum, independently of inflammatory action. Portal, Combalusier, Frank, and others have adduced instances of the accumulation in this cavity of air, independently of either disease of the membrane or perforation of the digestive canal. There is no doubt of the secretion of air from the digestive mucous membrane, independently of any obvious structural disease of it; and while the possibility of a similar phenomenon occurring in respect of the peritoneal coat of the digestive tube may be admitted, the rarity of its appearance cannot be questioned. Scoutetten believes that he has found air in the peritoneal cavity without any lesion of the membrane; but was it secreted there before death, or produced afterward? M. Ribes considers that an elastic fluid exists in the serous cavities, arising from the vaporization of a portion of the secreted serosity with which they are provided.

180. *c.* Perfectly *detached bodies* or *concretions*, generally of a rounded form, are sometimes found in the peritoneal cavity. They are of a semi-cartilaginous, cartilaginous, or even bony character. They vary in size from that of a pea to that of a cherry. Dr. Hodgkin remarks respecting their formation, that "they commence as an isolated clot of coagulated lymph, the smooth convex surface of which has contracted no adhesion, either to the serous or to any other portion of false membrane. In process of time the surface acquires a sufficiently membranous and firm consistence; and the detached body, instead of forming a clot of cheesy matter, contracts, losing its serous or watery part. If this take place rapidly, and materially reduce the size of the detached body, the surface exhibits an uneven and corrugated appearance. When of small size, they more often retain their smooth surface, an increasingly firm structure, which becomes loaded with earthy matter, as I apprehend, by a process of endosmosis. These detached bodies may be seen in the most recent state, wholly consisting of coagulable lymph, having a cellular character, infiltrated with serum, and presenting the figure and size of an egg-plum, somewhat flattened; but I have never seen them, in the firm and advanced stage which I have described, larger than a pea or a marble." (*Op. Cit.*, p. 53.)

181. Now without questioning that some of the bodies, in their recent or soft state, or in that of lymph, are produced in the manner for which Dr. Hodgkin has argued, or consist of portions of lymph thrown out with, or isolated by, a liquid effusion produced at the same time, still the subsequent changes, whether cartilaginous, or earthy, or bony, cannot be explained conformably with this opinion, even although the process of *endosmosis* be called in aid of it. I believe that the lymph, formed in a greater or less clot, or mass, and with more or less serous effusion, continues connected with the peritoneum by a narrow neck or pedicle, through the medium of which successive changes take place in it; and that, with the condensation and contraction of this mass, the pedicle also shrinks, becomes thinner, and is at last destroyed or broken off, the body ultimately being altogether detached. That it should undergo the successive changes of cartilaginous, osseous, or earthy degeneration, after its complete separation from the living structures, as Dr. Hodgkin supposes, is countenanced neither by analogy, nor by observation, nor by what is known of the process of endosmosis.

182. ii. The Symptoms of those organic lesions of the peritoneum which have now been described are extremely equivocal and obscure. Many of these lesions are detected only after death, and are associated with alterations of other or connected organs or parts, which assume a more prominent place in that state of more or less general disturbance, or of cachexia, which is usually present. Where there is effusion of fluid into the peritoneal cavity, this may be readily detected, but it may be complicated with one or other, or even with more, of those changes of the membrane which have just been noticed, and which the effusion may mark, or which may not be evinced by any characteristic phenomenon. When the alteration is of a malignant kind, it will generally be attended, at least at an advanced stage, by a cachectic, anæmial, and languid or debilitated state of the frame. Even when a distinct tumour is present, its exact seat will frequently be undeterminable, and it will be equally impossible to ascertain the extent to which the peritoneum is implicated by it. The matter can at best be one of inference, to which the physician will be led by a number of varying circumstances, many of them peculiar to individual cases.

183. Of all these lesions, probably hydatids, seated beneath the peritoneal covering of the liver, is that which is ascertained with the greatest certainty during the life of the patient. Yet this is not always the case, for much depends upon the particular part to which these parasites are attached, upon the size of the tumour they produce, and upon various attendant circumstances. But the symptoms are stated in the article Liver (§ 232). Some of the lesions, while they only partially, or even to a small extent, invade the peritoneum, are seated chiefly in organs or parts enveloped by this membrane; their precise seat being indicated chiefly by the way in which particular functions are disturbed, and the amount of the disturbance. If the lesion consist of a deposite of morbid or heterologue matter, occasioning more or less tumour, the seat and relations of it, viewed in connexion with the kind and extent of disordered function, and with the evidence of constitutional disturbance manifested in both the nervous, vascular, and cutaneous systems, will generally furnish some indication of the nature of the malady, particularly when aided by the state of sensibility evinced during a careful examination of the different regions of the abdomen and pelves, and by percussion. Still, the amount, as well as the exact nature, of the peritoneal lesion may not be made apparent; and it may not even be easy to ascertain whether or not the alteration be one proceeding from chronic inflammation, or one or other of those which I have now considered as being independent both of inflammatory action and of its usual results. It is chiefly by comprising within our mental vision all the circumstances

and phenomena characterizing the causes, origin, progress, and full development of the case, that an approach can be made to a just view of the nature of the distemper.

184. iii. The Causes of the organic lesions which I have viewed as altogether independent of inflammatory action, although sometimes associated with, or productive of, a state of asthenic or chronic inflammation, vary according to the nature of the existing lesion; each of these lesions proceeding from predisposing and exciting causes, which are more or less peculiar to it. Thus the *tubercular*, the *scirrhous*, or the *fungoid deposites*, formed beneath or invading the peritoneum, proceed from causes which are enumerated in the articles devoted to these diseases. The same remark applies to *hæmorrhagic*, *hydatidic*, and other changes implicating this membrane; these appearing from the same causes and in the same circumstances as give rise to them in other situations. Of all the alterations of structure, however, which have now been briefly noticed, it may be stated, in general terms, that they commonly proceed from, and are characterized by, both at their commencement and during their course, a condition of the vital powers and of the circulating fluids that have been fully described in the articles Debility and Disease. *Debility*, appearing either primarily or consecutively, as shown when treating of this subject, or, in other words, depression or exhaustion of vital energy, by occasioning those changes in the assimilating, the circulating, and depurating organs and functions, which I have fully developed in the articles Blood and Disease, gives rise to the several alterations of structure just described; one or other of them appearing, according as the predisposition resulting from original conformation, temperament, age, and modes of living, and as the influences exerted by air, climate, mental emotion, previous or concomitant disease, &c., determine its character or relations.

185. iv. The Treatment of organic lesions of the peritoneum, like the consideration of the causes producing them, should have strict reference to the nature of the alterations inferred to be present in each case. Still, the same principles are applicable to nearly all of them—whether of prevention, of alleviation, or of cure. It has just been stated that all these lesions generally originate in depression or exhaustion of vital power, and in its more immediate consequences in the assimilating, circulating, and depurating functions and organs; and a reference to those articles where these distempers are fully discussed, and with due reference to their causes, will fully confirm the general statement now made. It must, therefore, be manifest that a continuance of the primary morbid condition will necessarily aggravate or increase the consecutive changes, and thereby favour the development of the specific organic lesion, and its inroads upon the constitution. On the other hand, it must be equally evident, that whatever has the influence to remove the primary morbid condition; to rally or promote the depressed or exhausted powers of life; to aid the assimilating, circulating, and depurating functions, will most efficiently resist the progress of the organic mischief, and even overcome it ultimately (although we should seldom be so sanguine in our expectations), when it has not advanced so far as to impede the functions of life, or when it is not of a nature which precludes hope of ultimate success. By enabling the constitutional energies to resist the advancing evil, we may succeed in prolonging the contest; we may very considerably prolong life, even when we cannot hope to avert an ultimately fatal result.

186. Having determined the principle of treatment, the means which range themselves under it are readily suggested; the selection of them depending upon the inference drawn from previous and existing phenomena as to the nature of the particular case. The number and varying characters of the alterations just described, the different and even changing circumstances in which they appear, and the numerous visceral maladies with which they are generally complicated—these maladies often being the original evils from which the peritoneal lesion springs, or by which the membrane is invaded—preclude the possibility of noticing the several methods of treatment, the numerous means of cure or of palliation, and the interminable modes of combining these means that may be employed in these pathological conditions. I can only indicate the general character of the means which experience has shown to be most beneficial, and notice a very few from among these means which deserve to be employed.

187. I have just now contended that the only remedies which should be resorted to in the organic lesions of the peritoneum are those which support or rally the depressed powers of life. Unfortunately, many of these lesions invade the peritoneum consecutively of a protracted existence in some one of the viscera enveloped by this membrane, and not until vital depression and constitutional contamination have made considerable progress; or they may not come before the competent adviser until reasonable expectations of cure are precluded, either by their nature at their commencement, or by the amount of disorganization. Still, in either case, the chief *indication* is nearly the same for all, namely, *to enable the powers of life to resist as long as possible the farther progress of disorganization; and, when the case admits of the attempt, to aid them in removing whatever alteration of structure may have already taken place.* It is very obvious that this object can be attained only by those means which support, or rally without exhausting, vital energy; and which at the same time aid the due performance of the several digestive, assimilating, and depurating functions. Care should be taken always to keep the stomach in good humour, by the aid not merely of *medicine*, but also of suitable *diet* and *beverages*. The *medicines* most appropriate to the peculiar features and complications of the case should be selected, and their influence upon the functions of digestion and excretion carefully observed. Although tonic or restorative medicines are requisite, yet those which are the best suited to the circumstances of the case, and the temperament or idiosyncrasy of the patient, ought to be studied. Where there is increased irritability of the system, with a frequent or excitable pulse, the milder vegetable tonics or bitters only will be tolerated; and these may be prescribed with calmants, as the hydrocyanic acid, Hoffmann's anodyne, or with henbane, conium, morphia, or

other preparations of opium. If more or less anæmia be present, chalybeate medicines, selected and combined according as the peculiarities of the case suggest, are the most appropriate. It will be often beneficial to combine alteratives with tonics or restoratives; and the choice of those is generally difficult, as those which depress vital power or irritate the stomach are generally prejudicial. The preparations of sarsaparilla and of iodine are the most efficacious, when judiciously administered; but the latter should be prescribed in very small doses, especially at first, and the iodide of potassium be preferred. This medicine may be given with the liquor potassæ or with sarsaparilla, or in tonic infusions or decoctions; or with the liquor potassæ in Hodgson and Abbott's* pale ale, a beverage which I have for many years recommended in several disorders characterized by more or less debility. When the iodide of potassium is found to agree with the patient, the iodides of mercury may also be given in small doses at bedtime, with an anodyne or opiate. If anæmia exist, the iodide of iron should be prescribed in the sirup of sarsa, and the advantages of light and sunshine enjoyed as far as may be prudent. The several emunctories ought to be duly aided in their functions; the regular action of the bowels and of the kidneys promoted; and the insensible perspiration increased by wearing flannel next the skin, and by keeping the extremities always warm.

188. If the stomach be irritable, creasote may be given, with or without opium or acetate of morphia; or hydrocyanic acid may be prescribed in demulcents or emollients; and such *beverages* be selected as will support the strength, and agree best with the digestive organs. In some cases, the pale ale just mentioned may be made the vehicle of various medicines, according to the exigencies of the case; but in every instance, and particularly when the stomach is weak and irritable, tea ought to be avoided. Chocolate or cocoa-nibs are preferable; or a little milk, with seltzer, soda, potass, or magnesia water. The choice of these or of mineral waters should depend upon the nature of the case, and especially of the visceral disease characterizing it. The *diet* and *regimen* must be regulated by the same circumstances.

Bibliog. and Refer.—*Tulpius*, Observ. Med., l. iv., cap. 44.—*Graham*, in Philosoph. Trans., No. 460.—*Meckel*, in Mém. de l'Académie à Berlin, 1753, p. 102.—*Morgogni*, De Sedibus et Caustis Morborum, Epist., xvi., 30; xxii., 18; xxxviii., 52; lvii., 20.—*Lieutaud*, Hist. Anatom. Med., vol. i., Obs. 2, 3.—*Sandifort*, Observat. Anat. Pathol., vol. iii., No. 3; et Mus. Anatom., vol. i., p. 246.—*Bang*, in Act Reg. Soc. Med. Hafn., vol. i., p. 93.—*De Haen*, Rat. Medendi, &c., pars vi., cap. 4.—*Stoll*, Rat. Medendi, &c., vol. i., p. 290.—*J. Hunter*, On the Blood, &c., p. 244.—*J. G. Walter*, De Morbis Peritonei et de Apoplexia, 4to. Berl., 1785.—*S. Hulder*, De Morbis Omenti, 4to. Gott., 1786.—*Parr*, in Medical Dictionary, vol. ii., p. 21.—*Bichat*, Anat. Générale, t. i.—*J. P. Frank*, De Curandis Hom. Morbis, l. ii., Order iv.—*Portal*, Cours d'Anatomie Médicale, &c., 8vo. Paris, 1804, t. v., p. 126; et Mémoires sur plosieurs Maladies, t. iv., p. 249.—*R. T. H. Laennec*, Hist. d'Inflammat. du Péritoine, 8vo. Paris, 1804; et in Journ. de Médécine, vol. v. Paris, 1803.—*Jahn*, in *Stark's* Archiv., b. ii., st. 2, p. 131.—*Neumann*, in *Hufeland*, Journ. der pract. Heilkunde, b. xx., st., 2, p. 37.—*C. R. Pemberton*, On Diseases of the Abdominal Viscera, ch. i., 8vo. Lond., 1807.—*Greiner*, in Annalen der Heilkunst, 1811, p. 513.—*F. J. V. Broussais*, Histoire des Phlegmasies Chroniques, t. ii. Paris, 8vo, 1808.—*T. Sutton*, Tracts on Delirium Tremens and Peritonitis, &c., 8vo. Lond., 1813.—*Double*, in Journ. Génér. de Méd., t. xxiii., p. 378 (*Cartilaginous induration*).—*Gase* and *Monfalcon*, in Dict. des Sciences Médicales, t. xl., 8vo. Paris, 1817, art. *Péritoine et Péritonite*.—*Moncrieff*, Transactions of Medical and Chirurgical Society of Edinburgh, vol. i., p. 260.—*M'Dowel*, in Dublin Hospital Reports, vol. ii., p. 321 (*Acute Peritonitis consequent upon Rheumatism*).—*J. Copland*, Memoir on Chronic Peritonitis, with cases, &c.; in Lond. Med. Repository, vol. xv., p. 372, 8vo. Lond., 1821.—*D. A. G. Richter*, die Specielle Therapie, &c., b. i., p. 650.—*J. Baron*, An Inquiry into the Nature of Tuberculated Accretions of Serous Membranes, and the Origin of Tubercles and Tumours, &c., 8vo. Lond., 1819; and Illustrations of the Inquiry respecting Tuberculous Diseases, &c. Lond., 8vo, 1822.—*J. Abercrombie*, Pathol. and Practical Researches on the Diseases of the Stomach and Abdominal Viscera, 8vo. Edin., 1828.—*Gibert*, in Nouv. Bibliothèque Médicale, t. ix., p. 392 (*shows the ill consequences of allowing the presence of the menses to interfere with the institution of blood-letting*).—*Andral*, Clinique Médicale, Maladies de l'Abdomen, t. iv., p. 539.—*Roche et Sanson*, Elemens de Pathologie Médico-Chirurgicale, &c., 8vo. Paris, t. i., p. 585.—*Scoutetten*, in Archives Génér. de Médecine, t. iii., p. 500; et t. iv., p. 392; et t. v., p. 537.—*Legallois et Bouillaud*, in ibid., t. iv.—*Lombard*, in ibid., t. ix., p. 191.—*Broussais*, *Gasc. Abercrombie*, *Pemberton*, and *Monfalcon*, revd. in *Johnson's* Medico-Chirurg. Review, vol. i. p. 161.—*R. Bright*, Reports of Medical Cases, 2 vols., 4to. Lond., 1827–31, p. 453, et passim.—*Louis*, Recherches Anatomico-Pathologiques, 8vo. Paris, 1826 (*Peritonitis from Perforation of the Digestive Canal*).—*Graves*, Dubl. Hosp. Reports, vol. v.; and Dublin Journ. of Medical Science, vol. ii.—*Chomel*, Dict. de Médecine, t. xvi.—*Scoutetten*, in Lond. Med. Repository, vol. xxii., p. 333.—*A. N. Gendrin*, Histoire Anatomique des Inflammations, 2 tomes, 8vo. Paris, 1826; t. i., p. 61, *et seq.*—*Dugès*, Dict. de Méd. et Chirurg. Prat., art. *Peritonite*.—*Clarus*, De Omenti Laceratione, et Mesenterii Chordapso, Leips., 1830.—*E. Gintrac*, Observ. sur les Mal. Organiques du Péritoine, &c.; in Mém. et Observat. de Méd. Clinique, Bordeaux, 8vo, 1830.—*J. Cruveilhier*, Anatomie Pathologique, fol. Paris, 1833, livrais, xiii.—*M'Adam*, in Cyclop. of Pract. Med., vol. iii., p. 291; and *W. Stokes*, in ibid., vol. iii., p. 308.—*A. Velpeau*, De l'emploi des Mercuriaux dans le Traitemenit de la Péritonite, 8vo. Paris; and in Archives Génér. de Médecine, t. xix., p. 535.—*Gauché*, in ibid., t. xxi., p. 277.—*T. Hodgkin*, Lectures on the Morbid Anatomy of Serous and Mucous Membranes, in 2 vols., vol. i., of Serous Membranes, 8vo. Lond., 1836; sect. vi., p. 138.—*Symonds*, in Library of Medicine, vol. iv., p. 141, 8vo. Lond., 1840. (See the Bibliography and References to article Puerperal Diseases *for the Literature of Puerperal Peritonitis*.)

Peritonitis in Children.—*J. B. T. Baumes*, Traité de l'Amaigrissement des Enfans, accomp. de l'élèvation et dureté du Ventre, &c., 8vo., 2d edit. Paris, 1806.—*G. Gregory*, in Trans. of Med. and Chirurg. Society of London, vol. xi., p. 262.—*Billard*, Maladies des Enfans Nouveau-nés et à la Mamelle, &c., 8vo. Paris, 1828, p. 449.—*M'Adam*, Cyclop. of Pract. Med., vol. iii., p. 299.—*Cuming*, Trans. of King and Queen's Coll. of Phys. in Ireland, vol. v., p. 48.—*J. Stewart*, Practical Treatise on the Diseases of Children, 8vo. New-York, 1841, p. 266.—*Barthos* et *Rilliet*, Traité Clinique et Pratique des Maladies des Enfans, 8vo. Paris, 1843, t. i., p. 555; et t. iii., p. 400.

[Amer. Bibliog.—See American works on the Practice of Medicine, referred to under other Diseases; also, "A Treatise on the Practice of Medicine. By *George B. Wood*, M.D., Prof. of Mat. Medicæ and Pharmacy in the University of Pennsylvania; 2 vols., 8vo. Phil., 1847."—Many valuable cases and essays on Peritonitis are scattered through American periodicals, especially the American Journal of Medicine, which the reader may profitably consult.]

PESTILENCE.—Under the head *pestilence* I comprise certain maladies which have appeared as wide-spreading and devastating epidemics, but which have surpassed all other epidemics in their rapid extension, in their fatality, and in the duration of their prevalence. Nor have they appeared only as most fatal epidemics, for they have continued, in countries favourable to their perpetuation, to appear from time to time in a much less alarming and obtrusive manner; occurring for a time only in few or widely-scattered instances, and at more

* I recommend this beverage in preference to the various imitations of it which have more recently appeared, because I know that it is pure, well fermented, and prepared from the best materials. The utmost precautions are also taken against adulteration. For many years it was the only article of the kind, and it is still the most wholesome.

distant intervals, until certain favourable circumstances, arising out of predisposition, atmospheric constitution, or some unknown, but more generally-diffused influence, have arisen and rendered what had been either unsuspected or but little feared, suddenly most manifest, diffused, fatal, and appalling. To these irruptions, to their rapid extension, and to their great fatality, the generic term *pestilence* may be justly applied; and the history of medicine, in recent times, furnishes *three maladies* to which this term is especially applicable, namely, the recent distemper, which has generally, but injudiciously, been called *cholera*, *yellow fever*, and the *plague* or *pest*. To these might be added, perhaps, small-pox, scarlet fever, measles, and some other infectious fevers; but these diseases only occasionally, or even very rarely, and then only in peculiar circumstances and in certain races, assume forms which, as respects either malignancy, prevalence, or fatality, can entitle them to be placed in the same category with those now about to be considered.

1. If the *history of pestilences*, or of *pestilential epidemics*, be studied in Grecian, Roman, and Arabian writers, and in the writings of the fourteenth and fifteenth centuries, it will be manifest that the *causes* to which these pestilences were imputed are nearly the same as have been assigned in modern times. Hippocrates ascribed epidemics generally to the food, drink, and air; and Galen, with Lucretius, Avicenna, and others who copied him, considered atmospheric heat, and the miasms exhaled from the soil and from the putrid bodies of animals, as the chief causes of all pestilences. Avenzoar enumerates, as their sources, a warm and humid air, unwholesome food, and emanations from stagnant water and from dead bodies. Haly Abbas assigns the same causes as Avenzoar, but attributes a share of the influence to the nature of the seasons. From Homer to the present time, considerable influence in the production of pestilences has been imputed to great heat of the sun and to very hot seasons. Diodorus Siculus ascribed the plague of Athens and the disease which attacked the Carthaginian army in Sicily to the excessive heat of the sun, to exhalations from the soil, and emanations from the bodies of the dead. Ammianus Marcellinus considered extremes of heat or of cold, of drought or of moisture, exhalations from the earth, and the effluvia from the dead and from putrid animals, as the chief causes of pestilential epidemics. But, although these were assigned as the chief causes of pestilences by nearly all the ancient writers, still others, and particularly infection and contagion, were also viewed, as I have shown in the articles Epidemic Influence and Infection, as contributing to their propagation. Thucydides, as Mr. Adams, the learned translator of Paulus Ægineta, remarks, evidently considered the plague of Athens infectious, for he mentions that physicians were more attacked by it than others, as having most intercourse with the sick; and he describes the terror which the citizens felt to approach the affected, and intimates that it was often contracted by such intercourse. Many historians, poets, and physicians among the ancients, since Thucydides, have considered pestilential epidemics to be infectious—not always, however, by contact, but more generally by emanations from the sick, which contaminate the surrounding air, as shown in the article Infection (§ 11, *et seq.*). Marx, Omodei, Adams, and others have referred to the opinions of the ancients on this subject, in order to disprove what had been falsely alleged by a few writers of small reputation, that the doctrine of infection or contagion was altogether modern. That the ancients, however, entertained correct views of the matter is evident from a reference to the writings of Aristotle, Livy, Pliny, Dionysius of Halicarnassus, Diodorus Siculus, Appian, Plutarch, Quintus Curtius, Dio Cassius, Eusebius, Marcus Antoninus, Chrysostom, Seneca, and Isidorus Hispalensis. The last of these remarks, that "Pestilentia est contagium quod quum unum apprehenderit celeriter ad plures transit." "Pestilentia est morbus latè vagans et contagio suo quæ contigerit interimens."

2. A belief in the infectious or contagious nature of pestilential fevers and some other diseases was entertained by Aretæus, Cælius Aurelianus, Galen, Aetius, Paulus Ægineta, and by several of the Arabian medical writers. Mr. Adams remarks, that the result of his examination into the opinions of the ancients on this subject leads him to the conclusion that all, or at least the most intelligent of the medical authorities, held that pestilential epidemics are communicated, not by any specific virus, but by the contamination of the surrounding air by effluvia from the sick. As to this, as well as to other sources of pestilential diseases, the ancients did not differ materially from the best informed of the moderns. Indeed, faithful observers in all ages must have arrived at nearly similar conclusions; for, although various subordinate circumstances may have changed with the progress of time, and some causes may have assumed more intense, and others less prominent forms, still the chief and efficient sources and influences must have been reproduced in the succession of ages after indefinite intervals in those states and combinations which develop and propagate either pestilence or less malignant epidemics. If we consider the changes continually taking place near the embouchures of rivers with the progress of time, the deep and exuberant soil that is there accumulating, and the frequency of inundations; if we reflect upon the circumstances affecting the physical conditions of large cities, and upon the contaminations of the air, water, and soil, arising from these and other crowded and ill-ventilated places of human resort, we shall find causes sufficient to explain a portion of the morbid phenomena, but not the whole, which present themselves to the physician, especially during warm and humid states of the atmosphere, and under the influence of certain electrical conditions, or of unusual stillness of the air. Yet even these are not of themselves sufficient to account for all the phenomena which occur during the prevalence of destructive epidemics. Conceding all that can be contended for as to the baneful influence on the human constitution of exhalations from rich, deep, and humid soils into a warm, stagnant, and moist atmosphere; of effluvia from the exuviæ of living human beings and other animals congregated in masses in camps, cities, and towns; of emanations from dead and putrefying bodies, in-

sufficiently covered by the soil, and diffusing their elements through the soil, and transmitting them to the atmosphere within or around these localities; and of the water of these places impregnated with putrid animal matter; granting, in their full force of pestilential generation, the infecting influence of these causes, still an additional cause is required to explain many of the phenomena falling under the cognizance of the physician; and that cause often presents itself in a manner that cannot be mistaken, and, in many instances, in such a way as admits not of dispute. That other and most influential cause, often superadded to or generated by the foregoing, is *infection*, or, as I have shown in the article on this subject, the effluvium or miasm which emanates from the sick, contaminates the surrounding air, and the patient's day or night clothing, and thereby propagates to the healthy a disease similar to that from which itself proceeded, and often in circumstances and in situations where the other sources of the disease cannot have existed.

3. If the circumstances, physical and moral, characterizing congregations of our species, whether in camps or in cities, in ancient times, be considered as far as we possess the information, and be compared with those which exist in respect of similar congregations and localities at the present day, we shall find that, although a few causes of malignant disease are no longer in operation, others have sprung up, and have become excessively injurious, notwithstanding that numerous influences aid in counteracting or limiting the mischief. Many of the rites, even of religion and of superstition, during early ages and in pagan countries, tended remarkably to diminish the sources of infection and of pestilence. The embalming of the dead by the Egyptians and other ancient nations, the laws rigidly enacted by Moses and enforced by Jewish rulers, the burning of the dead by several nations, and the modes of sepulture adopted by the Chinese from the earliest ages, were all more or less calculated to prevent the bodies of the dead from proving sources of destruction to the living. But with Christianity, and with the superstitions which were successively ingrafted upon the purest and most sublime doctrines, sprang up practices of the most injurious tendency to public health, and these have now, particularly in large towns, advanced so far as to become matters of traffic with some of those who profess the greatest anxiety for the souls, if not for the health, of their species. The desire of depositing the dead within the consecrated sphere of spiritual instruction, or of boasted inspiration, became general, and the places of such deposite also became, especially in recent times, a source of emolument. Thus religion was made, even by the sanctimonious, the handmaid of Mammon; and often, in no lengthened process of time, the accumulated bodies of the dead furnished pestilential emanations, diffusing sickness and death among those who congregated in their vicinity. Thus, also, sleek hypocrisy, in the garb of sanctity, lured its victims within the sphere of infection, thereby increasing the rate of mortality, and at the same time augmenting its revenues by swelling the general mass of animal corruption, and multiplying the sources of infection. I have shown elsewhere (*see articles* Endemic and Epidemic Influences and Infection) that the accumulation of human exuviæ, and the interment of the dead among the living, and in places of frequent public resort, occasion, in the course of ages, a state of the soil which is most productive of noxious emanations, especially under the influence of a hot sun, and a warm, stagnant, and humid atmosphere, and which, moreover, contaminates the water in the vicinity. Thus ancient cities have generated the sources of their own decay, which circumstances have retarded or accelerated, according as these sources have been counteracted or augmented by legislative measures either of a beneficial or of an injurious tendency.

PESTILENCE, CHOLERIC.—Synon. *Pestilential Cholera*, *Pestilential Asphyxy*, *Asphyxia Pestilenta*, Author. *Epidemic Cholera*, Auct. Var. *Spasmodic Cholera*, *Cholera Spasmodica*, Auct. Var. *Epidemic Spasmodic Cholera*, Hawkins. *Cholera Asphyxia*, *Asiatic Cholera*, *Indian Cholera*, *Malignant Cholera*, various authors. *Convulsive Nervous Cholera*, Gray. *Hyperanthraxis*, Clanny. *Cholera Morbus*, *Cholera Epidemique*, *Cholera Asiatique*, Fr. *Die Epidemische Cholera*, *Asiatische Cholera*, Germ.

Classif.—II. Class, III. Order (*Author in Preface*).

4. Defin.—i. Nosological.—*Anxiety and oppression in the chest, epigastrium, and præcordia; disturbance of the bowels, with nausea, faintness, giddiness, and depression of vital power; frequent ejections of an offensive fluid, resembling rice-water, from the bowels and stomach, followed by spasms, tremours, distress; a cold, clammy, purplish, and shrivelled state of the surface; coldness and rawness of the expired air; a sense of painful or burning heat at the epigastrium, with urgent thirst, and rapid disappearance of the pulse; the distemper being often preceded by indigestion and diarrhœa, and frequently followed by febrile reaction, affecting chiefly the brain and abdominal organs.*

5. ii. Pathological.—*A discharge from the bowels and stomach of the watery portion of the blood; more or less complete paralysis of the lungs, and arrest of the changes effected by respiration on the blood, and of the hepatic and renal secretions; depression of the heart's action; the circulation of a thick, dark, or venous blood through the arteries, with congestion in the large veins, and imperfect circulation through the capillarics, owing to the thick, glutinous state of the blood; the congestion of the viscera in many cases being followed by an obscure or asthenic reaction, affecting chiefly the encephalon and abdominal viscera.*

6. I. Introductory Remarks.—Circumstances had induced the author to pay more than ordinary attention to the nature and progress of the pestilential cholera, from its irruption in Bengal to the present time. He had perused with the utmost care much of what has been published respecting it; and an opportunity had been afforded him of examining the reports and documents relating to it sent, from 1817 till 1827, by the medical boards and superintending surgeons of the three Indian presidencies, to the Board of Directors of the East India Company. He had frequent opportunities of observing and treating cases of the malady in this

country, and of examining the bodies of the dead. During these inquiries, he was particularly struck by some important facts, respecting which he conceived that much misapprehension and error were entertained and widely disseminated, and which required refutation. The *first* of these is connected with the origin and nature of the distemper. Many suppose it to be the common spasmodic cholera of warm climates, in an epidemic form merely, an opinion entertained by able writers, both in this country and on the Continent, until they had opportunities of witnessing it. This opinion was, however, opposed to the author's experience of the forms of cholera met with in warm and insalubrious countries, between which and the recent pestilence there is a very marked distinction; and it was contrary to the belief of the oldest European residents in India, and of the natives themselves, who might have been supposed to know something of the usual manifestations of cholera among them, unbiased by preconceived notions, or by medical system and authority. Instead of looking upon it as an aggravated form of cholera, they regarded it, wherever it broke out, as an unheard-of pestilence and scourge; and at its appearance whole villages and towns were deserted in consternation to escape its infection; while the greater part of the English practitioners, having been taught to consider cholera to consist of purging, vomiting, and spasms of the lower extremities, and finding these symptoms present in the distemper they were called to treat, believed it to be that disease merely, in an aggravated form, without taking into consideration much more important phenomena uniformly presented by it, and without sufficiently adverting to the fact that these symptoms are often slight, or nearly altogether wanting, in the most severe cases.

7. So strongly was the author struck by this misapprehension, that in the beginning of 1822, when editor of the Medical Repository, after noticing various facts connected with the disease, he observed, "A careful review of the symptoms of this disease convinces us that the deranged actions which take place in the system during its continuance, are no more those to which the term cholera morbus ought to be applied than they are those belonging to fever. It appears that this malady is the result of a peculiar cause, which impresses the vital energies of the system in such a manner as to subvert the power of reaction in many cases, and to render it imperfect and unavailing in others, without the assistance of art. The cause of the disease seems to act as a poison on the extensive surface of the bronchiæ and air-cells when the system is most liable to its attack; and, in many instances, it appears to destroy its victim in a few hours." (*Lond. Med. Reposit.*, vol. xvii., p. 407.)

8. That the author's opinion was neither prematurely advanced nor inaccurate, has been shown by the subsequent researches of the most eminent observers. He had treated many cases of spasmodic cholera in a warm and most insalubrious climate, and had experienced the disease most severely in his own person; and while he recognised in these cases the accurate description of Paisley, Curtis, Girdlestone, and Dr. James Johnson, he never met with, in any of them, the pathognomonic symptoms of the late pestilence. In this opinion he is borne out by the experience of every well-informed and candid observer who has seen the disease in this country, and who will readily concede that it is altogether distinct from the severe forms of common cholera. (*See art.* Cholera.)

9. The *second* error, which has been extensively propagated, both in this country and abroad, is, that the malady never exhibited any proofs of infection in the East. Knowing, however, from the best sources of information, that this statement is erroneous, the author has gone fully into the refutation of it, and has shown that much mischief has resulted from this opinion, and from the fact that, although evidence of its infection was everywhere furnished in India, no means of limiting the extension of the pestilence, no sanitary measures, were adopted in our Indian empire. That the distemper should extend less rapidly there, and exhibit its infectious property in a less remarkable manner than in Europe, was to be expected from free ventilation, and other circumstances tending to diminish the chances of infection, particularly among Europeans in warm climates.

10. A *third* error very generally entertained, both on the appearance of the distemper and in the present day, is, that it is caused by some unknown constitution of the air. But we have no instance on record of an epidemic of nearly thirty years' duration, without any interruption, unconnected with infection. Although the author admits that the pestilence is greatly aggravated by certain states of the air, to which the term epidemic is strictly applicable, notwithstanding our ignorance of the precise nature of these states, yet there seems no doubt that it is propagated, and prevails to a certain extent, independently of an epidemic concurrent influence. We know that some diseases are simply infectious without being epidemic; that others are both infectious and epidemic; and others are epidemic, and only contingently infectious. But the author believes that, like eruptive and typhoid fevers, this distemper is infectious, is not essentially epidemic, although it will, during favourable states of the atmosphere, &c., assume epidemic characters, and be modified accordingly. An attentive review of the various manifestations of the malady in India, throughout Asia, in Europe, and in America, seems to justify this view, and to confirm the conclusion as to its being a specific disease, arising from a specific cause, but promoted and disseminated more widely by the aid of various concurrent causes, among which epidemic, or unhealthy constitutions of the air; dirty, crowded, and close apartments; and crowding of the sick, are the most prominent.*

[* Whatever character cholera may have assumed on the other side of the Atlantic, and especially in India, we think we shall be borne out in the assertion that, in this country, it was essentially *epidemic*, and propagated by atmospheric influences, independently, in general, of infection. Thus its first approach was marked by a general prevalence of derangements of the digestive organs, which few, indeed, escaped, and which continued to prevail as long as the disease itself continued. When the epidemic influence was slight, *cholerine*, as it was called, prevailed, marked by languor, furred tongue, impaired digestion, colicky pains, and perhaps diarrhœa; but when this epidemic influence had attained a certain degree of intensity, then well-marked cases of cholera occurred, usually among the lower and intemperate classes; other cases soon occurred, not ex-

11. II. Progress and Mortality.—i. *Progress.*—Pestilential cholera first made its appearance in Jessore, a populous town in the centre of the Delta of the Ganges, and cut off the majority of those whom it attacked. It spread from the town in all directions, and reached Jaulnah, on the Madras side of the Indian peninsula, in June, 1818, and Bombay in August of the same year. It continued to spread and to prevail throughout all parts of India and the adjoining countries, and still prevails in many districts, although in various degrees of severity, and with intervals of complete immunity from its presence. Indeed, it may be said to have become naturalized in India, forming one of the diseases of the country.

12. During 1818 it visited, in an easterly direction, the Burmese Empire, the kingdom of Arracan, and the peninsula of Malacca. In 1819 it appeared in the isle of Penang, in Sumatra, Singapore, the kingdom of Siam, Ceylon, and the isles of France and Bourbon. During 1820 it reached Tonquin, Cambogia, Cochin-China, Southern China, Canton, the Philippines, &c. In 1821 it visited Java, Bantam, Madura, Borneo, and numerous other places in the Indian Archipelago. In the years 1822, 1823, and 1824 it appeared at Tonquin, Pekin, Central and Northern China, the Moluccas, Amboyna, Macassar, Assam, and various other Eastern countries and islands. During 1827 it prevailed in Chinese Tartary. In all these countries and places its prevalence and fatality were unprecedented in medical history.

13. In July, 1821, it reached, in its western course, Muscat, in Arabia; and, during the remainder of the year, visited various places in the Persian Gulf. In the following month it appeared in Persia, and, during 1822 and 1823, 1829 and 1830, it prevailed in several of the principal cities of that empire. It broke out in Bussorah and Bagdad in July, 1821, and in 1822 and 1823 ravaged most of the populous cities of Mesopotamia, Syria, and Judea.

14. In 1822 it reached to within 150 miles of the Georgian frontiers of Russia, and in 1823 appeared at Orenburg and Astrachan, beyond which it seems not to have extended until August, 1828 and 1829, when it reappeared at Orenburg, the capital of the province of that name, situated on the Tartar frontier, about 400 miles north of the Caspian, and about 1000 miles north of the places where it prevailed extensively in 1822. Its prevalence and fatality in this province were great, upward of a tenth of the inhabitants having been seized, and about a fourth part of those attacked having died of it. At the same time that the disease appeared in Orenburg, it was raging in several Persian provinces and Tartar tribes in Central Asia, from which it was supposed to have been introduced into Orenburg. At the commencement of 1830 the disease had entirely ceased in the Russian dominions; but towards the beginning of autumn it broke out with increased violence on the Georgian frontier of Persia, having appeared, in June, in the Persian province of Ghilan, on the southern shore of the Caspian, from the various southern ports of which it extended northward along the westward Caspian shore until it reached Baku, Tiflis, Astrachan, and numerous other towns in its progress into the heart of the Russian Empire. After attacking a number of places, it has continued to spread westward and northward through Russia, Poland, Moldavia, and Austria; visiting Moscow, Warsaw, and other places in Poland, and extending, in May, 1831, to Riga and Dantzic, and, in June and July, to St. Petersburgh and Cronstadt; early in October to Berlin and Vienna, and subsequently to Hamburgh, &c.

15. The distemper appeared for the second time in Astrachan near the end of July, 1830; and before the end of August upward of 4000 persons died of it in the city, and 21,270 in the province. After ascending the Volga it reached Moscow, became prevalent there at the end of September, and continued till February, 1831. It attacked about 9000 persons in this city, of which number more than one half died. It reached Riga in the middle of May, and St. Petersburgh on the 26th of June. From Astrachan it extended to the northern coast of the Black Sea, and in the course of the rivers into the central parts of Russia. It reached Poland in January, 1831, followed the Russian army in the subjugation of that country, and proved destructive in Warsaw and many other places during April and May. At the end of the latter month it appeared in Dantzic. In June it prevailed in Lemberg, Cracow, and other adjoining parts, extending through Gallicia and Hungary, and reaching Berlin and Hamburgh in August and September, and Vienna in the same months. It appeared at Smyrna in September, and soon afterward in Constantinople. The pestilence was conveyed by a caravan from Mecca to Cairo in August, 1831, some thousands having died on the road, and by the middle of September 10,400 Mohammedans, besides Jews and Christians, had died of it in this latter city.

16. Pestilential cholera appeared in England on the 26th of October, 1831, at Sunderland, a month afterward at Newcastle-upon-Tyne, and in December at Hetton, Houghton-le-Spring, North Shields, Tynemouth, South Shields, Gateshead, and other places. The first cases reported in London occurred on the 13th or 14th of February, in the immediate vicinity of the shipping, In Scotland the pestilence first appeared at Haddington about Christmas, 1831, and in Leith and Edinburgh about the 22d of January following. Although instances were adduced of sailors belonging to ships which had arrived from Riga, Cronstadt, Hamburgh, and Dantzic, and on board which individuals had died of the malady on the passage, being those first affected at the sea-ports in the north of England, still there is every reason to believe, from the information given me by several captains of ships who had left these foreign ports during the period when the distemper was prevailing there, that the infection was conveyed to many places in both England and Scotland in the clothes and bedding belonging to sailors who had died either in these foreign ports, or on the passage of the ships back to this country, the clothes and bedding of the sick and dead having been preserved without any purification, and given up to the relatives.

empting those of temperate habits, and who had never been exposed to the disease until it reached its acme; then the malady gradually died away, marked by the same tendency to bowel complaints which characterized its approach.]

17. From this country the pestilence was conveyed in an emigrant ship across the Atlantic to Quebec, many of the emigrants having died of it on the passage.* It appeared at Quebec on the 8th of June, 1832, and on the 10th at Montreal; and thence it extended to Kingston, on Lake Ontario, and all the surrounding parts. New York was attacked by it on the 24th of June, and Albany on the 3d of July. About the middle and end of July it spread to Newcastle, on the Delaware, to Philadelphia and several other cities, and thence to nearly all North and South America. It appeared at the Havanna in February, 1833.

18. The pestilence appeared at Calais on the 12th of March, and was believed to have been brought from England. On the 26th it broke out in Paris, where it carried off about 20,000 persons by the end of September, no precautions having been taken to prevent its extension, a general belief of its non-infectious nature having been erroneously entertained. During 1833 and the early part of 1834 it raged throughout Spain, and was very destructive in Madrid. It visited several parts bordering on the Mediterranean in 1834, and reappeared in London and in some other places in this country, as well as in North America, in the same year. It was most destructive in Rome in 1837, the number of deaths varying, for many days, from 200 to 300 daily. It spread to various other countries not mentioned in this brief sketch, between the years 1831 and 1837; and few places were entirely exempted from it, excepting those which were placed under strict quarantine. It still prevails (1845) in several parts of the East Indies.

19. ii. *The prevalence* of this pestilence and the *mortality* among those attacked varied remarkably in different localities, and in different races of the species, and were variously estimated by different writers. The mortality, as well as liability to attack, was certainly greatest among the poor and ill-fed; and among the dark races and those presenting the lower grades of constitutional power and of vital resistance to depressing agencies. The proportion of attacks to the population, and fatal cases in the whole number of attacked, were differently estimated, according as those cases which consisted chiefly of diarrhœa, or of the incipient stage, were comprised in or entirely left out of the account. Owing to these circumstances, nothing can be stated with any precision as to this point. In Arabia one third of the inhabitants of the towns which this pestilence visited was said to have died of it. In Siam, Java, and the Mauritius the number seized was extremely great, as well as the mortality. In China its fatality was still greater, especially in the more densely-inhabited places, owing chiefly to the neglect of precautionary measures. In Persia one sixth of the population of the principal cities and towns was cut off by it; and from one fourth to one third of the population of Mesopotamia was said to have perished. In Bassorah and Bagdad, situate in unhealthy localities, and in a humid atmosphere, a third of the inhabitants was carried off by it in little more than a month. At Erivan and Tauris it destroyed about one fifth of the population. But in more elevated and healthy situations it was much less fatal. In Syria its ravages were extremely varied; in some places one half of the inhabitants were swept away, while in others, as in Tripoli, only one perished out of every 200. During the prevalence of the pestilence in the southern and eastern provinces of Russia, in 1830, the mortality was also various. At Tiflis three fourths of the sick, at Astrachan two thirds, were carried off. Out of 16,000 attacked in the province of the Caucasus, 10,000 died; at Moscow one half, and at Orenberg one fifth only perished. According to the author last quoted, out of 54,000 and upward attacked in the provinces of Russia, in 1830, more than 31,000 died. In Hungary alone about 400,000 persons were said to have been seized, and more than half the number to have died.

20. In Astrachan one third of the cases were said to have been fatal; among the Don Cossacks two thirds. At Moscow the mortality varied greatly, being at first so high as nine tenths of the cases, and afterward sunk gradually to a third. When the disease first appeared in India, the mortality was also extremely high; but its prevalence, as well as its fatality, gradually abated after 1821. Exceptions, however, to this amelioration presented themselves in various places; and at the same period, when the rate of mortality did not rise above 8 or 10 per cent. in some parts, from one fourth to two thirds of the persons seized by it died in other places.

21. Of the prevalence and mortality of the distemper in this country, Dr. W. Merriman has furnished the following table from the Reports sent to the Privy Council Office. It must have been evident, however, to all who paid attention to the matter at the time, that the reports were not even approximations to correct statements; for, to my own knowledge, several deaths from the disease in my own neighbourhood occurred without having been reported as such, and very numerous cases were treated successfully during the early or premonitory stage which were either not viewed as cases of the malady or not returned as such. The *prevalence* and *rate of mortality*, as far as my own observation enabled me to judge, were remarkably increased by previous ill health, by debility, and by advanced age. The number of cases which occurred before puberty was very small, and from that age to thirty the proportion of recoveries was greatest. From forty to fifty the proportion of deaths increased remarkably, and after fifty years of age but few recovered. But much appeared to depend upon the violence of the attack at the beginning.

	Cases.	Deaths.	Recoveries.	Population of places affected.
England,	49,594	14,807	33,790	2,753,958
London,	11,020	5,273	5,745	1,424,896
Wales,	1,436	498	938	101,603
Ireland up to March, 1833,	54,552	21,171	33,381	

[The following table, compiled by Prof. J. Jackson of Philadelphia, exhibits the cases and deaths in Quebec, Montreal, New-York, and

[* It is by no means certain that the cholera was conveyed across the Atlantic in an emigrant ship, as stated by Dr. Copland; all attempts to trace the introduction of the disease into Quebec in this manner have proved unsatisfactory.]

Philadelphia, with the ratios of cases and deaths to population and to each other.*—(*Amer. Jour. Med. Sciences*, vol. ii., p. 291.)]

Date of report and place.	Population.	Cases.	Deaths.	Ratio of cases to pop.	Ratio of deaths to cases.	Ratio of deaths to pop.
Sept. 2. Quebec,	32,000	5783	2218	1 in 5 17	1 to 2½	1 in 14½
" 21. Montreal,	28,000	4440	1904	1 in 65	1 to 2⅓	1 in 14⅔
Aug. 28. N. York,	140,000	5814	2935	1 to 24¼	1 to 2	1 in 47
Sept. 13. Philad.	160,000	2314	935	1 to 70	1 to 2½	1 in 173

22. III. Description of Pestilential Cholera.—The nature of this pestilence is best inferred from a faithful history of the phenomena manifested by it during its progress, and of the changes it produces in the organization, and from the means found successful in limiting its extension and in restoring the frame to its healthy state when subjected to its attack. In conducting an inquiry into the phenomena and nature of this pestilence, I shall confine myself to the more important topics of the subject, and endeavour to arrive at inferences founded on careful observation and extensive experience.

23. Since the first irruption of the malady in the Delta of the Ganges, during its various manifestations in India and other parts of Asia, and in its different visitations of northern and western countries, whether observed in British India, in Siam, Java, and the adjoining islands; in China, in Tartary, in Arabia, Persia, Syria, or in Russia, England, and other countries of Europe, or in America; whether attacking the Hindoo, Mussulman, the Malay, the Mongul, the Asiatic, Caucasian, or the European branches of this race, the characteristic features of the disease have been uniformly the same; modifications as respects grade, or intensity of attack, and as regards the severity and the occurrence of the consecutive fever, being the chief sources of distinction. Age, constitution, and varying degrees of predisposition frequently occasion different manifestations of certain functions, or peculiar forms of disturbance, yet still the principal phenomena continue but little modified excepting in degree; and it is not until consecutive changes are induced in the system by the morbid actions characterizing the disease, that any marked difference manifests itself, such difference evidently proceeding from pre-existing states of the internal viscera, innate vigour of constitution, and the remedial means employed to remove the attack. This uniform character of the malady indicates a specific cause, with which, however, several others may combine, favouring its action by disposing the frame to its invasion, by re-enforcing its activity, or calling it into operation after the body has been exposed to its influence.

24. The specific cause producing the disease may be supposed not only to be thus re-enforced by other causes, some of them of no mean influence, but itself may vary considerably in intensity, producing, *cæteris paribus*, effects of coordinate severity, yet still acting with a certain relation to the predisposition of the individuals exposed to it. This may be more clearly illustrated by taking for granted the operation of a certain infectious product or poison, the existence of which will be shown in the sequel. This product or effluvium emanating from the bodies of those attacked with the disease, often in a form rendered manifest to the senses of the observer, necessarily varies as respects concentration and quantity, dilution in the air, and rapidity of dissipation by means of ventilation; its effects, therefore, may reasonably be supposed to vary equally in grade, the state of predisposition to become affected by it being the same. Where, however, the predisposition is great, as after great fatigue, during mental depression, &c., a less concentrated and abundant effluvium proceeding from the affected, will produce a more intense effect than this principle in its most active and concentrated form, acting upon a person but slightly predisposed; while this intensity of cause will altogether fail of producing any marked effect in the strong, the unpredisposed, or the person whose moral confidence and equanimity generally repel the invasion of any form of infection.

25. Thus, therefore, the manifestations of the malady will be modified chiefly in grade, and scarcely at all as respects its form. In these respects the efficient cause of the disease is perfectly similar in its operation to the causes of other infectious diseases familiarly known, and frequently observed in an epidemic form; when the poisonous emanation is concentrated and intense, the subject being also predisposed to its invasion, its effects are rapidly produced, remarkably severe, and speedily arrive at a termination. On the other hand, when weak or much diluted, or when the predisposition of the subject is slight, its operation is slow, and the train of morbid actions of longer duration and diminished severity. Thus I have seen a person struck down nearly inanimate by the infectious effluvium proceeding from the bodies of the sick, and concentrated in a close apartment, and death following in a few hours without the energies of life being rallied; and similar results have been often observed by others. Owing, therefore, to the intensity of the efficient cause of the disease, to the number of concomitant causes which may re-enforce its action, and to the state of predisposition of those exposed to them, the modified results which I am now about to detail will present themselves.

26. i. *A. Symptoms.*—The *invading* or *preliminary symptoms* of the disease generally consist of pallor and collapse of the countenance, with an expression of anxiety; slight pain of the forehead, noise in the ears, and vertigo; sickness, heat, and pain at the epigastrium; oppression at the chest, with frequent sighing; nervous agitation, remarkable loss of muscular power, general uneasiness; colicky pains in the abdomen, with slight diarrhœa, at first feculent, but afterward watery or serous; sickness at stomach; slight cramps of the legs; oppressed, weak, small, slow, or creeping, and sometimes intermitting pulse, and coldness, clamminess, or humidity of the surface. These symptoms are of varied duration—of one, two, or even three days, sometimes of several hours

[* The above table does not include the whole period of the epidemic, but may serve to give a comparative view of the disease in those cities respectively to the dates mentioned. The population of New-York is estimated not from the usual ordinary number at the above period, but of those remaining in the city.]

only, and at other times not of as many minutes. In some cases they have been scarcely remarked, the patient having been struck down almost lifeless, with a dark or livid state of the surface, and all the symptoms characterizing the fully-formed state of the disease.

27. Dr. Smith observes, that several of those about to be attacked may be seen with a peculiarly dark ring round their eyes;* and others state that the features evidently collapse, and the expression becomes anxious for a day or two, or at least for hours, before they sicken. At Orenburg, dyspeptic symptoms are stated to have preceded its attack, and a similar observation has been made in other places. Various authors have said that stomach and bowel complaints, of a less serious nature, often preceded a fully-developed seizure for a day or two; and that these complaints have likewise occurred in the place where this pestilence has prevailed, and been removed by treatment, or disappeared spontaneously, without being followed by the fully-developed distemper. This, indeed, agrees with my own experience during the prevalence of the malady in London; for although but comparatively few were carried off hy the pestilence, yet very many experienced severe indigestion, flatulence, and diarrhœa, with marked vital depression, sometimes with slight spasms; these ailments being either removed by restorative and astringent medicines, or successfully resisted by the powers of the constitution. And I may add, that there were very few medical men who did not experience these symptoms in their own persons—at least the dyspeptic symptoms, if not the diarrhœa—during the period of their attendance on cases of the distemper.

28. *B.* The *fully-developed state* of the malady consists of great vertigo, nervous agitation, oppression at the chest and præcordia, with complete loss of muscular energy; cramps, commencing at the fingers and toes, and rapidly extending to the trunk; slow, thready, and weak pulse; great collapse of the countenance, the eyes being sunk deep in their sockets, and surrounded by a dark circle; vomiting and purging of a fluid resembling whey, or rice-water, containing whitish flocculi [or green, porraceous-like matter]; a peculiar sharp and contracted state of the features, and wild and terrified expression of countenance, arising from a feeling of rapidly-approaching dissolution. The whole surface, particularly the hands, face, and extremities, assumes a leaden, hlue, or purplish tint, varying in shade with the intensity of the attack and complexion of the person; the extremities are shrunk, shrivelled, sodden, and the skin is deadly cold, damp, and raw to the touch; the nails assume a bluish-white hue; the pulse is either reduced to a minute thread, or is entirely lost at the wrist, and often can with difficulty be felt in the neck; the course of the large superficial veins is marked by flat lines of a darker tint than the adjoining surface; a burning heat and inexpressible anxiety are complained of at the epigastrium; the patient tosses about incessantly, from a feeling of intolerable weight and anguish round his heart; he struggles for hreath, and often lays his hand on the stomach and chest, referring his agony chiefly to those situations; his voice is nearly gone, and his respiration is quick, irregular, most laborious, and imperfect; the inspiratory act being effected by an immense effort, and expiration heing quick and convulsive. The patient calls frequently for cold water, speaks in a plaintive whisper, and utters only a word at a time, the lungs not containing air enough for a sentence. The tongue is always moist, often white and loaded, and generally flahby and cold. A thermometer introduced below the tongue indicates an animal temperature frequently of ten or twelve degrees below the standard of health. The sense of touch is generally greatly obscured, and deafness is often present. If blood be obtained in this state, it is hlack, flows by drops, is thick, and feels colder than natural; and the air which is expired is cold and raw. Vomiting and purging, which are far from being the most dangerous symptoms, and are often the most remarkable in the least urgent cases, are generally slight, or at least not profuse, in those attacks where the sinking of the vital energies is the most rapid and the greatest, or are readily allayed by medicine. The integuments of the abdomen are often raised into irregular folds, while the epigastrium and hypochondria, with the whole abdomen, are commonly, especially in the intensely severe cases, drawn inward and upward upon the chest.* The spasms are generally of a more or less passive kind, but they sometimes, particularly in the loins, legs, and thighs, present a tetanic rigidity. They are often slight, or nearly absent, in some of the most rapidly fatal cases, or replaced by a constant tremour. There is occasionally a low whine of suffering expressed. The secretion of urine is totally suspended, as well as the biliary, the salivary, and lachrymal fluids; and a peculiar earthy odour issues from the body, with a singular fetor of the perspiration and evacuations.

29. These are the symptoms in the more severe attacks, varying, however, somewhat in degree, and with the occurrence or non-occurrence of previous diarrhœa. When the intense attack takes place without previous diarrhœa, then the vomiting and purging of watery or rice-coloured fluid—from the escape of the watery portion of the blood from the digestive mucous surface—are most marked; the quantity of this fluid thrown out, both upward and downward, in a few minutes, heing often extremely great. If the remedial means succeed, the animal heat is slowly restored, the pulse becomes fuller, and the colour of the surface more natural; hut if these means fail, rapid extinction of the functions takes place. Frictions even then may reduce the lividity of the part to which they are applied, but that of the face and hands

[* This is not a dark ring, but an actual dark-blue or black *cavity* below the lower eyelid, and the pure result of the intensely morbid activity of the absorbents every where, and which here have removed a portion, or all, of the fatty cushion of the globe of the eye, thus leaving the blue veins visible through the skin. This blue colour below the eye is frequently seen in the morning, in nervous temperaments, from some previous anxiety of mind and feverishness, and, therefore, quickened action of the absorbents, producing the same result to a certain degree. The same marked activity of the absorbents, and consumption of the subcutaneous fatty matter, causes the remarkable symptom of puckering of the skin in this disease.—T.]

[* Broussais correctly describes this sensation as similar to a band drawn tightly across the epigastrium, as if compressing the stomach against the spine.—T.]

increases. The lips and cheeks sometimes puff out in expiration, as in apoplexy; and, towards the close of the scene, the respiration often becomes slow, with a quivering of the tendons of the extremities. The mind is generally undisturbed, the patient feeling merely a certain degree of apathy towards the close, and a desire to be left to his fate. At last he is unable to swallow; he then becomes insensible, and he dies after one or two long, convulsive sobs. In some cases, when the patient has been thus rapidly cut off, without any rallying of the energies of life, convulsive motions of the muscles have been remarked an hour or two, or even longer, after expiration had ceased.

30. Such is the history of the disease when it terminates life without any reaction of the nervous and muscular systems, the patient generally dying in from six to twenty-four hours; but both in the East and in Europe, particularly the latter, or among European residents in India, a consecutive state of disease, attended with efforts at reaction of an imperfect or malignant character, was not unfrequently observed. It was rarely evinced in the weak Hindoo, or in the previously debilitated, of whatever race, but sometimes in the stronger or less predisposed in India, and often in Europe, and in England, especially in the robust and young.

31. From the aggravated state which has been now described but very few recover, particularly if that state have existed as long as three or four hours before active treatment has been resorted to. A thread of pulse, however small, is almost always felt at the wrist, where recovery from this state is to be expected. Hiccough, coming on in the intermediate moments between the threatening of death and the beginning of reaction, is a favourable sign, and generally announces the return of circulation.

32. In less severe cases the pulse is not wholly extinguished, though much reduced in volume; the respiration is less embarrassed; the oppression and anguish at the chest are not so overwhelming, although vomiting, and purging, and the cramps may have been more intense. The coldness and change of colour of the surface, the peculiar alteration of the voice, a greater or less degree of coldness of the tongue, the character of the liquids evacuated, are invariably well marked in all the degrees of violence of attack of this pestilence. In no case or stage of this disease have I observed shivering; nor have I heard, after inquiry, of more than one or two cases in which this febrile symptom took place.

33. *C.* The *consecutive phenomena* of this malady vary considerably. In the East, when recovery took place from the previous state, it was often rapid, and without much subsequent disease having been experienced. The numerous writers, however, in the reports from the medical boards of the three Indian presidencies make particular mention of a consecutive fever, characterized by nervous and malignant symptoms, such as I am about to enumerate, and which was very commonly observed to follow the attack in Europe. They also state that the malady often passed into visceral disease and dysentery, and that the danger was not over, although they succeeded in rallying the powers of life. According to Drs. Barry and Russell, after the blue or cold period has lasted from twelve to twenty-four, seldom to forty-eight hours or upward, the pulse and external heat begin gradually to return; headache is complained of, with noise in the ears; the tongue becomes more loaded, redder at the tip and edges, and also drier. High-coloured urine is passed with pain, and in small quantities; occasionally is nearly or altogether suppressed; the pupil is often dilated; soreness is felt on pressure over the liver, stomach, and belly; and an offensive odour is exhaled from the surface; in short, the patient is now labouring under a continued malignant fever.

34. A profuse critical perspiration occasionally comes on from the second or third day, and leaves the patient convalescent; but more frequently the quickness of pulse and heat of skin continue; the tongue becomes brown and parched; the eyes suffused and drowsy, with a dull flush, stupor, and heaviness of the countenance, resembling typhus. Dark sordes collect about the teeth and lips; and sometimes the patient is pale, squalid, and low, with the pulse and heat below natural, but with the typhous stupor. The urine is suppressed. Delirium generally supervenes, and death takes place from the fourth to the eighth day, or even later, in the very person, too, whom the most assiduous exertions had barely saved in the cold stage. Dr. Reimer states, that of twenty cases treated under his own eye, who fell victims to the disease, seven died in the cold stage, and thirteen in the consecutive fever. This proportion nearly agrees with that observed in my own practice, or among the cases to which I was called. In two cases which I attended most extensive erysipelas complicated the consecutive fever. I agree with the observation of Drs. Barry and Russell, that persons employed about cases in this typhoid stage are never attacked with ordinary fever, but with a genuine cold, blue cholera.

35. In another class of cases serious disorders of the secreting organs of the abdomen, particularly of the liver and of the digestive tube, supervene, instead of the low nervous fever now described. The evacuations from the bowels become of a dark, blackish, offensive, and highly irritating kind, and attended frequently with discharges of a bloody fluid, with mucus, and extremely urgent irritation of the rectum, the consecutive symptoms assuming nearly the character of dysentery. Sometimes an inflammatory or sub-inflammatory state of the stomach and bowels takes place either alone, or accompanied with great tenderness in the region of the liver, and disorder of the biliary secretion. In other cases these symptoms assume very nearly the form of bilious or gastric fever; and in a few this state of disease is associated with inflammatory congestion of the lungs. When these states of consecutive disease are severe, they not seldom carry off the patient; and, where recovery takes place, are frequently accompanied with tedious convalescence.

36. *D.* The *points of difference* between the manifestations of this pestilence in India and in Europe appear to be chiefly the following: 1st. The precursory dyspepsia and diarrhœa appear not to have been so frequent in India,

especially in dark races, as in Europe. 2d. The evacuations seem to have been more profuse and ungovernable in the violent attack in the former than in the latter, although the characters of the evacuations were entirely the same. 3d. Restoration to health from the cold state, without passing through consecutive fever, was by far more frequent in India than in Europe, nor did the consecutive fever there so generally assume a typhoid type. 4th. The proportion of deaths in the cold, compared with those in the consecutive stage, was far greater in the former than in the latter country; and, 5th. The proportion of medical men and hospital attendants attacked seemed greater in Europe than in the East. Relapses, also, in the hospital attendants were not unfrequent; while convalescence was generally perfect and rapid elsewhere. Mr. Jameson states, in the Calcutta Reports, that, although relapses were not uncommon, there seemed to exist an immunity from second attacks, but this is not fully ascertained.

37. It may, perhaps, be difficult to explain the frequency and the modified state of the consecutive disease now described as it was observed in this country and throughout Europe. Much, perhaps, may be owing to the state of predisposition, the intensity of the cause, and the constitution of the affected; something, also, may be attributed to the effect of treatment in the early stage of the malady, particularly the more general employment of blood-letting and large doses of calomel: means evidently calculated to remove the oppressive congestion of the vital organs, and reanimate the functions of the secreting organs and emunctories of the frame, but which seemed not to have been so generally nor so decidedly resorted to in Europe as in India. Something, also, may be imputed to the greater vital resistance made to the noxious influence exerted by the poisonous miasm causing the distemper upon the frame, by the European constitution, than by the more delicate constitution of the dark races.

38 ii. *The Prognostic Symptoms.—A.* Those symptoms which indicate a *favourable* termination of the disease are, increase of the firmness and fulness of the pulse; returning animal heat to the surface; a tonic character of the spasms, or active retchings; not very urgent feelings of heat and anxiety at the epigastrium and præcordia, or a diminution of these symptoms, and of the pressing desire for drink; the occurrence of hiccough; a more natural and a livelier state of the countenance and surface of the body; greater freedom of respiration, and a diminution of the rawness and coldness of the respired air; a free evacuation of the bowels, with the appearance of a return of the hiliary secretion, and especially the evacuation of urine and amelioration of the tremours, restlessness, and general distress. These generally indicate a decrease of danger in the early stage of the disease, and returning vascular reaction; but this state may proceed to a fatal issue with all the symptoms of congestive and adynamic continued fever.

39. Typhoid symptoms, such as low delirium, black sordes on the teeth and lips, dry, parched skin, &c., may, however, come on, and the patient sink. The non-accession of these symptoms; the occurrence of a copious, warm perspiration; the return of the natural secretions and evacuations, as of the salivary, bilious, and urinary secretions; the absence of serious affections of any of the viscera contained in the abdomen, particularly of the liver, stomach, and bowels; and a return of the functions of the nervous, assimilating, circulating and respiratory organs to their natural state, are the chief guides of the physician in forming a favourable prognosis.

40. *B.* On the other hand, an *unfavourable* issue must be looked for when the prostration of strength, the coldness and blueness of the surface, the sinking and irregularity of the heart's action, the collapse of the countenance, the coldness and rawness of the expired air, the oppression and difficulty of respiration, the anxiety and restlessness, &c., are great or, individually, extreme; and especially if, with great intensity of these phenomena, the retchings and spasms are slight, or the latter consist chiefly of tremours, or irregular clonic contractions. An oozing from the mouth of the fluids from the stomach, unconscious evacuations or relaxation of the sphincters, the breathing consisting of convulsive sobs or being stertorous, with puffing of the cheeks or lips, and inability to swallow, indicate approaching dissolution in the cold or early period of the disease.

41. The occurrence of low delirium, or of coma with collapse of the countenance, and all the symptoms of malignant continued fever, consecutive of the cold stage, are extremely unfavourable, especially when attended by suppression of urine, by great stupor, dark sordes about the teeth or lips, by convulsive tremours of the tendons, and restlessness. These symptoms show that the congestion of the nervous centres, which occurred in the preceding periods of the disease, together with the thick and otherwise morbid state of the blood itself, has been followed by serious disturbance of the capillary circulation in the substance of the brain and of its membranes, probably conjoined either with effusion beneath or between the arachnoid membrane, or with continued congestion of the veins and sinuses of the encephalon. The continued suppression of urine is manifestly owing as much to the change produced in the blood, by the evacuation of the watery part of it by the bowels, as to a paralyzed state of the kidneys.

42. The supervention, also, of tenderness, pain, &c., in the region of the liver, or in that of the stomach, a very morbid and irritating state of the alvine evaeuations, with blackish, bloody, and mucous discharges, attended with tremours, &c., all indicate, respectively, the consecutive appearance of inflammation, or inflammatory congestion of the liver, of the stomach, and bowels (§ 46), and evince a marked tendency to disorganization, and call upon the practitioner for the employment of the most decided means of cure. Although these consecutive phenomena show a most serious state of disease, yet recovery will sometimes take place from it by the assistance of well-directed means.

43. iii. *Morbid Appearances observed after Death.*—The morbid changes observed after death from this pestilence are in every respect the same, both in Eastern and in European coun-

tries. When the cold stage proves fatal, or death takes place within four-and-twenty hours from the seizure, but little change of organization can be detected, although the viscera are much altered in *appearance* from the healthy state. The surface of the body usually presents the same aspect as mentioned when describing the fully-formed stage of the malady, being livid, corrugated, constricted, and humid. The lungs are commonly found collapsed, condensed, sometimes remarkably shrunk, and always loaded with black blood of an oily or ropy consistence, and very closely resembling tar or treacle. The cavities of the heart are filled with a black blood, and they frequently contain polypous concretions. Blood of a similar appearance is generally found in the arch of the aorta and other large arteries. The blood-vessels of the brain and its membranes are more or less gorged with dark blood, particularly toward its base. The arachnoid membrane is frequently deprived of its transparency. A serous fluid of various quantity is often found effused between the convolutions of the brain and in the lateral ventricles. Similar appearances to those detected in the cranium are also found in the vertebral column.

44. The abdomen, upon being opened, generally emits a peculiar offensive odour. The stomach and different parts of the bowels are frequently partially, but considerably contracted; at other places greatly distended with flatus; the internal surface of the stomach sometimes seems but little affected. A whitish or yellow fluid matter, resembling the evacuations, is often observed in different parts of the alimentary canal, which occasionally contains much air, but neither bile nor fæces.* The internal surface of the intestines is commonly lined by a tenacious muco-albuminous matter. The colon is frequently much contracted, generally throughout. The mucous membrane and sub-mucous cellular tissue of the digestive canal present evident marks of congestion, in some cases approaching to a sub-inflammatory state, but generally in spots or patches of various sizes, the colour of these varying from a very dark venous congestion to a more roseate hue. Decided signs of inflammation are always wanting, even in the most remarkable of those congested states. The glands of Brunner and Peyer, as well as the solitary glands, are greatly enlarged. Both stomach and bowels are frequently of a paler colour than natural, both in their inner and outer surfaces. The liver is generally pretty full of dark-coloured blood; the gall-bladder often much distended with tenacious ropy bile, of a dark yellow or green colour. The gall-ducts are sometimes contracted, at other times not. The appearance of the pancreas, spleen, and kidneys is various, frequently differing but little from their natural state; in other cases somewhat gorged with blood. The urinary bladder is always contracted and empty. The vena porta and all the large abdominal veins are loaded with black blood, resembling tar.

45. The chief change observed in cases terminating fatally in the blue stage of the distemper is in the *blood*, which has lost the greater part of its serum, which, as it has exuded from the digestive mucous surface, has left an albuminous coating over the mucous membrane, and that remaining congested, thick and treacle-like, in the large veins.

46. In cases the duration of which extends from one to three days, the same leading appearances as now described are observed, but often with considerable additions. The vessels of the stomach in these are found loaded with blood, presenting a surface sometimes of a pale pink hue, sometimes of a deep blue, at others of so dark a tint as to resemble sphacelus of the membrane, from which, however, it was readily distinguished by the firmness of the texture. Similar changes are found in the small intestines, and but very rarely in the larger. In many, evidence of congestive pneumonia is found, which is usually latent before death. In those cases in which coma occurs, serum is sometimes effused in larger quantities than already alluded to, but occasionally congestion only of a very black fluid or semi-fluid blood is found. Those who die of the consecutive disease show few appearances that are different from such as are usually observed in other cases, attended with corresponding symptoms. Those cases which have evinced, during the secondary fever, marked disturbance of the brain, generally present, after death, greater vascularity of the substance of this organ and of the membranes than natural, with the congestion of blood in the veins and sinuses, and effusion into the ventricles and between the membranes, particularly between the pia mater and the arachnoid reflected over it. In some cases the brain seems dusky or mottled, and the veins turgid, with dark semi-fluid blood. In those terminating fatally, with hepatic disturbances, the liver is generally of a dark-brownish or sodden appearance. In some cases it is of a purplish black, somewhat enlarged, its veins filled with dark semi-fluid blood, and the ramifications of the hepatic duct loaded with a dark-green or greenish yellow bile. The stomach and bowels, particularly the latter, are contracted and thickened, the inner surface softened, of a dark-red or purplish colour, in patches or streaks; sometimes excoriated, partially detached from the muscular coat, and covered with a muco-sanguineous fluid, in those who have died with consecutive gastro-enteric or dysenteric symptoms.

[The pathological changes observed in subjects dead of cholera in this country correspond closely with those described by Dr. Copland. Prof. Horner, however, of Philadelphia, has published a very elaborate account of these changes in the *Am. Jour. of Med. Sci.* (vol. xvi.), in which he maintains the following propositions:

1st. That the vascular derangements and phenomena of cholera, as exhibited in the alimentary canal, are confined almost exclusively, if not entirely, to the venous system.

2d. That in the earlier stages a lining membrane of coagulating lymph exists in the small intestines at least, if not in the stomach and colon also, and that this lining resembles the membrane of croup.

[* The complete suppression, suspension, or extinction, as it were, of the urinary and biliary functions, is equally characteristic of yellow fever. Not so in typhus; here the kidneys only are paralyzed, while the liver, though torpid, responds to aperients or enemata, and even a diarrheal tendency is not unusual.—T.]

3d. That, in addition to the enlarged and tumefied follicles described by M. Bouillaud, and a similar enlargement of the intestinal papillæ described by M. Serres, a copious vesicular eruption, entirely distinct from both, and easily distinguished from them, exists in the mucous membrane of the stomach of the small intestines, and of the larger; and that this vesicular eruption, consisting of small spheres, seldom more than the sixth part of an inch in diameter, is probably the essential morbid character of the disease, as is the case with the eruption of smallpox and other affections.

4th. That the follicular system of the alimentary canal is not the principal fountain of the sero-fibrinous discharges, commonly called the cholera fluid, but that the latter comes from the capillaries of the venous system. Prof. Dickson, of Charleston, S. C., remarks, in relation to Prof. Horner's observations, that he is "unable to yield an unhesitating credence to details differing in their alleged uniformity from, and thus contradicting, all former accounts, which, until now, agreed in the ascription of extreme irregularity to the local affections in cholera."—(*Essays on Pathol.*, vol. ii., p. 84.) We have made numerous autopsies in this disease, and have not only found the glands of Peyer morbidly developed, but the small, isolated follicles much enlarged, giving rise to the appearance of vesicles and vesicular eruption, as described by Prof. Horner. Was not the membrane described by Prof. H. probably the epithelium, and might not its detached portions give rise to the flocculent appearance noticed in the discharges?]

47. IV. Diagnostic Characters.—Much misapprehension of its nature and origin has arisen from viewing the pestilential cholera merely as a modification of, if not identical with, the form of cholera not unfrequently met with in India and other warm climates, and occasionally in this country, to which the terms *spasmodic cholera* and *mort de chien* have been applied. Many writers, particularly those who argue against its infectious nature, have considered this pestilence merely an epidemical occurrence of that form of cholera. It is true that, in the spasmodic cholera, the secretion of bile is either altogether or nearly interrupted; or, if it be at all discharged into the bowels, that it is so vitiated as to prove extremely irritating to their internal surface, the spasms, retchings, alvine evacuations chiefly arising from intense irritation of the organic nerves supplying the digestive tubes and the abdominal viscera, together with accompanying congestion of these vessels. In that disease there is every reason to suppose that the absence of bile is to be imputed to spasm of the common bile duct, rather than to a suppression of the secreting and excreting functions; while, in pestilential cholera, these functions are altogether arrested, and the discharge of bile is interrupted, independently even of any spasm of the excreting ducts, the bili arysecretion being suspended as well as the urinary, owing not only to a paralyzed state of the liver and kidneys, but also to the state of the blood being such as not to admit of circulation through the extreme capillaries, and to the loss of its serum.

48. In the spasmodic, or severe form of sporadic cholera, the discharges from the stomach and bowels are certainly either not coloured by bile, or but little, excepting at the commencement, and when the disease begins to yield; but they are accompanied with a different train of symptoms. The spasms are more tonic, and confined more to the muscles of the abdomen, and of the thighs and legs, than in the pestilential disease; and, in the former, the vertigo, deafness, headache, marked affection of the respiratory function and of the circulation, characterizing the latter, are entirely wanting.

49. In sporadic or bilious cholera the very dark, thick, and ropy appearance of the blood; the cold, wet, and shrivelled state of the surface, and its leaden, dark, or purplish colour; the almost total absence of pulse at the wrist; the very marked and rapidly-increasing collapse of the powers of life; the disagreeable and earthy odour of the body, even during the life of the patient; the burning sensation between the scrobiculus cordis and umbilicus; the complete arrest of the glandular secretions; the cold tongue and mouth; and the coldness of the respired air, which characterize the pestilential disease, are entirely absent.

50. In one the powers of life are certainly very much deranged, and the circulation and functions of the internal organs greatly disturbed; but in the other all the derangements and their attendant symptoms are of a much more alarming and malignant nature; the balance of the circulation is much more completely overturned, the circulating fluid itself much more sensibly and seriously diseased; the respiratory functions infinitely more disturbed; the spasms of the voluntary muscles more general, and more clonic as respects their nature; the purging and vomiting slighter and of shorter duration, and forming a less prominent feature of disease; the surface of the body more deprived of its vitality, of a much darker colour, and more collapsed and shrunk; and the powers of life are more completely overwhelmed, and sooner sink altogether, than in the severest forms of cholera observed to occur occasionally in warm climates, or in temperate countries, under circumstances favourable to their appearance.

51. In this pestilential malady the powers of life are insufficient of themselves, even although assisted by the administration of stimulants, to overcome the congestion of the internal organs, and restore the circulation in the surface of the body and in the extremities; and while the large secreting viscera in the abdomen remain engorged by the thick and viscid blood thrown in upon them from the external surface, and their vital powers thus overwhelmed, their functions of secretion must necessarily be arrested; and thus they are unable to remove the load oppressing them by one of the modes in which congestion of secreting organs is usually overcome.

52. In the severer forms of cholera, occurring sporadically, the derangements, being less malignant than in the present malady, are more readily removed by an energetic and appropriate treatment. Here the exhibition of large doses of calomel, opium, and stimulants is generally sufficient to allay the inordinate action of the stomach and bowels, to restore the balance of the circulation, to remove spasm,

and to excite the secreting function of the liver. But in this pestilence the lungs are completely paralyzed, the changes produced hy respiration entirely suppressed, the blood is thick and vitiated, the large vessels, particularly the large venous trunks, and the cavities of the heart, are so engorged with blood as to be unable, particularly in their state of deficient vital energy, to react upon the distending fluid, and to throw it, particularly in its state of morbid density and tenacity, into the extreme vessels of the secreting organs and external surface, unless internal and external stimulants of the most powerful kind be employed ; and even these are very often inadequate, of themselves, to fulfil the intention with which they are employed, and occasionally are productive of mischief, unless the engorgement of the internal viscera be early removed by vascular depletion and external medication, which, while they relieve the heart and empty the large vessels, enable them to react upon their contents, and recall the flow of blood from the centre to the circumference of the frame. Hence it is generally indispensable, in this very formidable disease, to exhibit stimulants and antispasmodics internally, with artificial heat and stimulating frictions, in order to rouse the vital energy of the system, while we remove the vascular load by means of emetics and evacuations of blood, and afterward endeavour to excite the functions of the liver, and restore the secretions generally.

53. Among the other characteristics intimately connected with the nature of this pestilence, and calculated to distinguish it from all those states of disease to which the term cholera has been usually applied, may he particularly noticed the prevalence of the pestilence in all seasons, countries, and climates ; the affection of the head, nervous system, and respiratory organs, characterizing the commencement of its attack ; the uncommon and sudden diminution of the animal temperature, which often sinks below the heat of the surrounding air, both on the surface of the hody and in more internal parts ; the remarkably sudden and rapid depression of the powers of life ; the continued restlessness and distress referred to the præcordia and epigastrium ; the mental apathy and indifference to the result ; the vertigo, stupor, and deafness ; the blue colour and shrunk appearance of the surface of the body ; the state of the respiratory actions, and peculiar groan or whine of the affected ; the unquenchable thirst and hurning at the epigastrium ; the sodden, raw, wet, and shrunk state of the surface ; the rapid exudation of a watery fluid from the skin, and digestive mucous surface ; the states of disease by which it is very frequently followed ; the unprecedented mortality, notwithstanding the most energetic and judicious treatment, and the use of those means by the aid of which nearly all the cases, even of the most severe forms of intertropical cholera, generally recover ; and, lastly, the appearances observed after death, particularly the collapsed state of the lungs, the blackness of the blood, the fibrinous concretions in the cavities of the heart, the morbid secretion lining the internal surface of the intestines, the flaccidity of all the soft solids and of the substance of the heart itself, and the congestion of black blood on the large nervous centres. (*See* § 43, *et seq.*)

54. The *secondary fever and consecutive phenomena* (33), which follow upon the cold and blue stage of the malady, also furnish remarkable proofs of dissimilarity between this pestilence and the severe forms of cholera observed in hot countries, or in temperate climates after very hot and moist seasons. After these latter the patient recovers without any consecutive disease, and frequently the tumult of the frame leaves it benefited by the changes it induces ; but in the present pestilence the consecutive states of disease are as dangerous as the blue stage ; and, even when assuming a typhoid or febrile character, they do not communicate a febrile disease, but the distinct and specific pestilence now treated of. This important feature was happily insisted upon in the reports of Drs. Barry and Russel, and is one of itself sufficient to distinguish this pestilence from every form of cholera.

55. Various attempts have been made to trace a resemhlance between this disease and some of those which have occurred in former ages, and of which very imperfect accounts have been furnished by writers ; but, upon referring to the meagre details which have been given of them, I am unable to trace any close resemblance between them—far less identity. Mr. Orton has endeavoured to find out a very close similarity between this pestilence and that which ravaged England and some parts of Europe at various periods, between the years 1483 and 1551, and which obtained the name *Sudor Anglicanus*, *Ephemera maligna sudatoria*, *Sweating sickness*. In certain phenomena the similarity is close, but in others altogether wanting ; but as it cannot lead to any practical results, I will not further pursue the subject.

56. It may bc important, however, to he aware that poisoning from acrid and narcotic substances, and particularly tobacco, or those belonging to the class of animal poisons, occasions symptoms which, in many respects, closely resemble those characterizing this pestilence. But the difference will be apparent upon inquiry into the history and premonitory symptoms of the attack, and by observing thc collapsed, shrunk, dark, and wet state of the surface of the body ; the sodden, shrivelled, damp, and raw state of the extremities ; the spasms, the oppressed respiration, the sunk appearance of the epigastrium, and of the hypochondria ; the peculiar character of the matters ejected ; the cold, raw state of the expired air, and the black, viscous condition of the hlood, all of which characterize this pestilence, and are either altogether absent from every other kind of attack, or never similarly associated.

57. After attentively considering its phenomena and nature, I would conclude, 1st. That this malady, as respects the causes which occasion it, and as regards the pathological states which constitute its various grades or stages of intensity, is quite distinct from all the forms of cholera, whether the common *bilious* variety, or the more severe form, usually denominated *spasmodic*, the *mort de chien*, &c. ; and that, therefore, the name cholera should be discarded from all scientific descriptions of it.

58. 2d. That the accounts which we possess

of the epidemics and pestilences which have ravaged various countries in former times do not furnish us with the history of any disease which may be considered as identical in its nature with this pestilence; and that it must, owing to this circumstance, and to the uniformity of its characteristic phenomena, be viewed as being of modern origin, and *sui generis*.

59. As it is important that the name of a disease should not be such as may risk its being confounded with another, different from it in its nature, symptoms, and termination, so I consider that some other name than that at present applied to it should be given it. As to the particular appellation which may he employed, I conceive that one pointing to its chief pathological states, and its prominent tendencies, ought to he preferred. The intense influence of its exciting cause upon all the respiratory actions and functions, as well as upon the actions of the heart and state of the pulse, and its marked tendency to propagate itself, and to terminate fatally, have induced me to apply to it the name of *Asphyxia pestilentia*, or *pestilential asphyxy*.*

60. V. Causes and Nature of Pestilential Cholera.—There are few subjects which have given rise to greater diversity of opinion, or to more discussion, than the causes of this disease. Suppositions have been adduced, and reasoned from, as established and admitted facts; and repeatedly observed occurrences and corroborated evidence have been explained away or denied, even by those who have given us merely vague hypotheses and chimerical speculations in their place. It must be evident that but little truly important can be stated in respect of the causes and nature of this malady, without previously inquiring into, and coming to some conclusion as to its infectious or non-infectious nature. I shall, therefore, inquire, in the *first* place, into the evidence which has been adduced as to its possessing an infectious property from its commencement in Jessore, and as to the extent and character of this property. Its predisposing and concomitant causes will *next* come under consideration; and, *lastly*, various topics connected with its nature will be discussed.

61. i. *The infectious nature of Pestilential Cholera demonstrated.*—The infectious or non-infectious nature of this disease is one of the most important topics to which public attention can be directed; and one which, owing to the manner of viewing it, adopted both in this country and on the Continent, requires the serious consideration of the informed part of the community. Knowing that much important information had been furnished by the medical observers of the disease in India, which was entirely overlooked, I carefully examined the reports to the Medical Boards of the three Indian presidencies. I had also an opportunity of referring to the medical reports at the India House. From those sources, therefore, and from others within my reach, I can state that much misapprehension of this terrible disease had gone abroad, and been propagated by authorities that should have been more accurately informed on the subject. I can truly state that, although my attention has been much engaged by this disease, since the time of its eruption in the Delta of the Ganges, I approached this topic with my mind entirely unbiased, and desirous of adopting that view of it which well-ascertained facts should most fully support. When, therefore, professional authorities have stated opinions which have misled, and will still further mislead, those who have it not in their power to detect their unsoundness, it becomes the duty of those who have detected the true character of these opinions to place the particulars within the reach of the misinformed. One able writer remarks, as an acknowledged and proved fact, "that by an overwhelming majority of the British medical officers, who have witnessed epidemic cholera in the East Indies, this disease is not considered to be of a contagious or infectious nature. A few incidents occurred which excited suspicions in the observers that it might really, after all, possess this property. But scarcely a single person has advocated the doctrine of contagion with any earnestness." The same writer afterward stated, that "the almost unanimous and earnest recommendation of British practitioners was not to consider the cholera contagious." In another country an eminent physician, in an elahorate memoir on the disease, read very recently before the "Académie Royale de Médecine" of Paris, states, as a well-ascertained matter, "that in India the medical men and attendants on the sick were not more frequently seized hy the disease than others of the community." Other instances of gross misstatement, made both by foreign and British writers, may be adduced, but these will suffice. Now, when we turn to the great authorities on the subject—to the official depositories of the origin and rise of this pestilence—we find that all the reports, the Bombay, the Madras, and the Calcutta, favour the infectious nature of the disease more or less. It is true that a majority of the surgeons and assistant-surgeons in India, who sent reports to their respective medical hoards, state that they do not believe the disease infectious; but a large number of them give a very different opinion, while the reasons assigned by many for believing the disease to result from other causes than infection are actually favourable to the existence of an infectious property. Even where they have argued against its infectious nature, they have often adduced the strongest evidence, although unconsciously, of its possessing this property.

62. When I entered upon the present inquiry, and commenced with the reports from the three presidencies, in the order of their appearance, and before I had seen the disease in this country, I had not completely made up my mind on the subject of its infectious nature. But, in order to come to a just conclusion, I had recourse to the earliest and the best information, and read and noted every individual report which these bulky publications contained; and so far are the remarks just quoted wide of the truth, so far are the medical men of India nearly unanimously against the belief in cholera possessing an infectious property, that the members of the

[* The radical mischief and lesion, no doubt, begins in the lungs, from the poison inspired, which immediately, through the pneumo-gastric and other nervous connexions, simultaneously implicates the stomach; the respiratory organs thus can not eliminate the carbon and hydrogen of the blood, and the stomach is no longer capable of furnishing to the respiration the elements of ombustion; hence the entire train of morbid phenomena.—T.]

Medical Board of Bombay, in the preface to the reports sent to them, and published at Bombay in 1819, state that the disease had extended from Poonah to Panwell, a considerable village in the main line of communication between Poonah and Bombay; that a man who had left Panwell and arrived at Bombay, a distance of about fifteen miles, was soon afterward attacked by the disease, and communicated it to those attending him; that it was traced in parts adjoining Bombay, and on the island, from village to village, by the arrival of persons affected with it from places where it was known to prevail; and that there were places which, from want of this sort of communication, had, up to the time of the report, entirely escaped. From the foregoing and other data, the members of the Bombay Board—the first to furnish information respecting the disease—conclude that "It appears to them incontrovertible, that this disease is capable of being transported from one place to another, as in cases of ordinary contagion or infection, and also to possess the power of propagating itself by the same means that acknowledged contagions do, that is, by the acquisition of fresh materials with which to assimilate." (*Bombay Reports*, &c., p. 10, 11.) In the same reports we find Captain Sykes stating that he ascertained that the disease did not break out in any village "until that village had communication with a neighbouring place in which the disease existed;" and he furnishes several instances proving this fact. Besides, he states that the attendants on those first seized in his company were attacked, and that it spread from one of his servants to five, while the gentlemen in the next tent had not one affected; and he remarks that he could add similar instances to those now adduced. (*Op. Cit.*, p. 118.) Mr. Coats, surgeon, in a letter to the president of the Bombay Medical Board, states, that the idea most prevalent was that the disease was brought from Jaulna to Aurungabad, and that its progress could be traced distinctly through the villages on the chief road from Nagpore to those places (p. 145). He afterward states that the information as to the extension of the disease by infection was not only furnished by Europeans, but that some Brahmins had given similar information without any particular inquiry on the subject having been made of them. From these and other facts, he concludes by considering the disease infectious; and that, "If it was occasioned merely by a distempered state of the air, it would have spread over the country with some regularity; but the epidemic seems generally to have travelled in lines along the post-roads, and always to have required a succession of subjects for its propagation. In Candeish, where there is not sufficient population and but little intercourse between the villages, its progress was slow. At Pundergoor it made its appearance at the time of the great Jatra, and was spread at once in all directions by the pilgrims returning to their homes." (*Op. Cit.*, p. 150, 151.)

63. Dr. Jukes states, that the disease travelled along the high-road from the Deckan to Panwell, and that he has not heard of any village in the Conkan that has had the disease but by intercourse with places in which it had been already prevalent. "If it be something general in the atmosphere," he remarks, "why has it not hitherto made its appearance in some two distant places of the province at the same time? Nothing of this kind has, I believe, been observed: it still seems to be creeping from village to village, rages for a few days, and then begins to decline." (P. 173.)

64. Dr. Taylor reports that, "whenever the disorder appeared in any particular spot or family, a considerable proportion of the family or neighbours were attacked within a very short period of each other: on many occasions I have seen three or four of a family lying sick at once" (p. 195.) Dr. Burrell informs us that in the short space of six days every attendant, in his hospital, on the patients affected with cholera had the disease. (*Bombay Report*, p. 9.) And Mr. Craw states that every one of the attendants, thirty in number, in the hospital of the 65th regiment were attacked.

65. The next report which issued from India was edited by Mr. Jameson, and was published at Calcutta in 1820. This gentleman, while he reasoned in an extremely loose manner against the existence of an infectious property having been evinced by the disease, and without furnishing proofs of its absence, actually adduces evidence of that property which he is endeavouring to disprove. Thus, where he is stating in general terms, and without any reference to reports from the different medical offices in the establishment, that the disease did not seem to be more prevalent in the tents or hospitals of the divisions of the army, in which the sick were treated, he communicates the following important fact in a note: "A Sepoy died of the pestilence. Five of the corps, who had shown no signs of illness, were employed to carry the body to the grave. They were all seized with the disorder during the ensuing night, and all died." (*Calcutta Rep.*, p. 130.) Mr. Jameson, instead of appearing as the editor, or publishing reporter, of the opinions sent to the Calcutta Board, states his own views, endeavours to explain away those which are different from them; and thus the publication, which in the title-page professes to be a report, conveys not a single line of information from any one on the Bengal establishment, excepting this writer himself. The work, therefore, can not be looked upon as furnishing the opinions of the majority of medical men in this part of India, inasmuch as we find no authorities or opinions contained in it but those of Mr. Jameson himself; and these are evidently so perfectly at variance with one another, and with the ascertained laws by which those diseases which are familiarly recognised as infectious are governed, that we cannot, even although we receive some of the facts which he adduces, consider him as an authority on this subject. In all his remarks he seems to suppose that contact is requisite to the propagation of contagious diseases, and that, because some persons in contact with the sick so frequently escape, the cholera is not contagious. He overlooks the influence of predisposition, which is so remarkably influential in all maladies which perpetuate themselves; and he entirely forgets the operation of those causes which often come in aid of the poison or effluvium exhaled from the bodies of the diseased, even after the exposure of a healthy person to

it, and which frequently determine its action or call it into operation, when, without such reenforcement, it may have failed in producing its specific and deleterious effects. Could this gentleman ever have had any experience of diseases admitted by all to be infectious—had he ever seen smallpox, measles, or scarlet fever? Notwithstanding those misapprehensions, and the evident bias which he betrays in favour of pestilential cholera being non-infectious, numerous facts escape him eminently calculated to support the opposite doctrine. Thus he informs us that the medical staff present with the Hansi force was "*persuaded*" that the infection extended to it from the Meerut detachment, which caught the disease on passing through Delhi, where it prevailed. And at another place he informs us that the centre division of the Bengal army were infected by a detachment which joined it while subjected to cholera. He endeavours, however, to explain away this occurrence; but it is evidently shown, and even admitted by himself, that the pestilence was introduced into this division, either by this detachment, or by some of the Rajah of Sumpter's troops, which were affected, and mixed with some regiments of the division.

66. After proceeding through a number of pages, in which Mr. JAMESON reasons against the infectious nature of the disease, what was my surprise when I found him, towards the conclusion of his observations on the subject, express himself in the following manner: "This much, however, may be affirmed, from a review of the whole progress of the epidemic in this quarter, that the infectious medium, in whatever it consisted, was confined within a very circumscribed circle, and was very slowly extended to healthy parts of the atmosphere. If, setting aside the circumstances militating against it, we take it for granted that the infection was truly received by the centre and Hansi divisions from the detachments above mentioned, we must believe that the disorder, although not communicable by contact from person to person, was so from one large body to another large body; and that whenever the poison got head among a number of men, it assumed some new quality, so as, when mixed with the atmosphere, to become infectious. What constituted this additional quality we can not pretend to determine; but in support of its existence, we may quote the predilection of the epidemic for cities and camps; the infection of the left division, and the Nagpore and Meerut troops, immediately after entering into the diseased medium at Jubbulpore, Nagpore, and Delhi; and the similar case of the troops and followers in attendance upon the governor-general being attacked shortly after communicating with an infected village in the Gorruckpore district. To the same account may be placed the progressive march of the disorder from one part of an infected place to another, as in the centre and Hansi divisions, and more particularly the Rajpootana force, in which the virus seemed to be regularly propagated from corps to corps. In some instances the suffering body would appear to have sickened immediately upon coming into the poisonous medium, as was the case with the Nagpore troops, who were affected on the very day in which they encamped at the infected village of Gaongong; but more frequently one or two days would seem to have been requisite to bring the virus into action. Thus the Meerut detachment entered Delhi on the 29th, and was not affected till the 31st; thus, too, the Hansi troops had not the disease till the 6th, the day after the junction of that detachment. Again, by those abetting the opinion of the disorder being communicated to the centre division by the Shergur detachment, it is stated that the first cases occurred on the 11th, two days after its junction. Lastly, the followers of the troops in personal attendance on the governor-general in April first suffered on the 23d, three days after encamping near the infected village." (P. 144–146.) This surgeon afterward adds, that the disease recently appeared in a detachment of the Rajpootana force under such circumstances as at first seemed to warrant a suspicion of the existence of contagion. Now it appears somewhat surprising that the secretary of the Medical Board of Calcutta, sitting under the eyes of the governor-general, should have been allowed to issue his ipse dixit as to the non-infectious nature of a most devastating pestilence, then in its full strength, when these facts were in his possession, and when many others of a still more convincing character of the infectious nature of the distemper had passed through this very board in their way to the India House, in Leadenhall-street, where I had an opportunity of consulting them in 1827.

67. The foregoing quotation will be found to differ but little from the conclusions which an attentive consideration of the subject has led me to entertain. I have thought it right to be thus particular in the investigation of this subject, because upon the adoption of correct ideas respecting it will mainly depend the employment of successful measures to circumscribe, entirely to prevent, or counteract the disease. And I hesitate not to maintain that, owing to the very loose manner in which this subject has been considered, and to the neglect of means which the due interpretation of the information furnished even by the most skeptical as to the existence of infection, among the reporters to the India medical boards, ought to have led, are to be imputed, in no small degree, the propagation of the disease not only throughout India, but also to other parts of Asia, to Europe, and to America. I have thought it most advisable to go to the original sources for information as to this and various other topics, because the opinions of the Indian reporters were generally derived from an extensive and varied experience of the disease during a number of years, and they were not certainly previously biased in favour of contagion, that being a property which the diseases of India seldom present. While, also, the information which they furnish is of a superior description to that which has appeared elsewhere, the impossibility of obtaining it in this country—particularly the reports, the most valuable part of it—has induced me to refer to them in preference to other authorities. Having shown the identity of the Indian with the European pestilence, the arguments derived from facts observed in the one are equally applicable to both; and, therefore, I pursue the present topic, and farther demonstrate, from the valuable and voluminous reports published

by the Madras government, the inaccuracy of the opinions which have gone abroad respecting the disease in India, and which have vitiated the doctrines and paralyzed many of the measures, both preventive and curative, which have been adopted in Europe.

68. Mr. Scott, the editor of the reports which were transmitted to the Madras Medical Board, and were published at length at that presidency, has given an able summary of the evidence which was furnished to him, in conjunction with the results of his own observation. The value of the information here conveyed, its accordance with the most accurately observed facts connected with the manifestation of the disease in Europe, and the difficulty of access to the original, will be a sufficient apology for the length of the following quotations: "Bodies of troops in motion have been attacked, and have retained the disease, while it was unknown to the fixed inhabitants of the country through which they passed. One of two corps in a camp has been attacked, and the other has escaped the disease. Ships arriving from other parts of the world have never suffered under the assumed epidemic constitution of the atmosphere before reaching the shore." "Diseases avowedly infectious, such as smallpox, measles, &c., have not at all times the power of spreading epidemically; for while it is certain that their exciting causes are never wholly extinct, it is only at particular periods that these diseases become epidemic; but we are unacquainted with the circumstances under which this power of epidemic propagation arises. The same may be the case with cholera. All the atmospheric phenomena, and other circumstances brought under the head of occasional causes, have, with little or no interruption, existed from the beginning of time until now, without producing cholera; consequently, the superaddition of a new cause must be inferred. An European, proceeding on his journey to Trichinopoly, on the 15th October, was taken ill about a mile from the Mount, brought back to the house where he had passed the day, and there died. On the 17th the wife of that person, on the 19th the owner of the house, and on the 21st his wife, all experienced attacks of cholera, but recovered. Several of the native servants also suffered. The instances of the disease appearing at places immediately after the arrival of corps and detachments which were suffering from it are very numerous. For example, it appeared at Jaulnah immediately after the junction of a party from Nagpore, among whom it prevailed. It appeared at Aurungabad, and at Malligaum in Kandeish, after the arrival of parties who had left Jaulnah at the time the disease was prevalent there, and among whom it had broken out on the march to these places. It appeared a second time at Malligaum, after the junction of the 1st battalion of the 5th regiment, in which cholera prevailed. It appeared at Secundrahad after the arrival of a detachment suffering from it, and it appeared afterward in the villages through which the detachment had moved. It appeared at Gooty, where no case had been observed for six months before, immediately after the arrival of the first battalion of the 16th regiment of foot, in which it prevailed with great mortality. It is remarkable that the same formidable type of the disease which prevailed in the marching corps was communicated to the corps at Gooty. It also spread on that occasion to the adjacent villages. It also appeared in a detachment of artillery, previously perfectly healthy, upon their encamping on the ground which had been immediately before vacated by the 1st battalion of the 8th regiment, in which corps the disease prevailed. The bodies of several persons who had died of cholera remained exposed on the ground when it was taken up by the artillery. The prisoners in a jail, enclosed by a high wall, have escaped cholera, while it prevailed all around them; and the inhabitants of certain hilly ranges have also escaped the disease. These have been said to have interdicted all intercourse with the people below. When cholera is once established in a marching regiment, it continues its course in spite of change of position, food, or other circumstances. Its approach to a town has been traced from village to village, and its first appearance in a town has been in that quarter which was nearest the track of its progress. The sudden appearance and disappearance of cholera, however unlike the progress of known infectious diseases, is not admitted as being irreconcilable with the doctrine of infection, especially if the disease be of sudden invasion after the application of the exciting cause. The relations who have attended on people ill of cholera, as well as the nurses appointed in military corps for that duty, and in general those whose employment has led them to be much with the sick, have been observed, in very many instances, to be attacked with cholera during, or shortly after, their attendance. The sick in hospitals labouring under other diseases have likewise been observed to be attacked with cholera, especially those who lay near the patients ill with that disease. Sometimes whole families have been swept off successively.* Servants have often been observed to sicken after attending their masters." (*Madras Reports*, p. xlviii., *et seqq.*)

69. This, however, is only a portion of the facts and circumstances advanced by Mr. Scott in proof of the infectious nature of this pestilence. In addition to the foregoing, I may add the opinion of several able and experienced surgeons and physicians, contained in their reports to the Madras government: Superintending Surgeon Duncan states, that "the 34th regiment carried the pestilence with them from Bellary to Nundydroog, and there was no trace of the disease in any village on the road. Since the regiment passed, every village on the road has been attacked by cholera." (*Madras Rep.*, p. 111.) Mr. Train adds, that "the attacks have shown a great disposition to run in families, and even among the attendents on the sick, and have in such cases been much more severe than usual." (P. 131.) Mr. England observes, that "the disease has been greatly felt among the attendants on the epidemic patients at various places." (*Op. Cit.*, p. 170.) He also notices the extension of the disease from troops and travellers to places on the

[* This rapid transmissibilty and maturity of the disease in persons to whom it is communicated is another peculiar feature in its contagious character. This extreme rapidity of development is in perfect keeping, also, with the often astonishingly rapid termination of the disease, in death.—T.]

roads through which they had passed, and other facts similar to those already recorded in proof of its infectious nature.

70. Mr. Chapman, after stating facts perfectly in accordance with those furnished by the reporters already quoted, adds, that he feels most confident of having experienced the attack of the disease, under which he had with difficulty recovered, from infection. Being anxious about a patient, he remained with him for several hours, watching the progress of the disease. He felt nausea on quitting him, but attributed it to the peculiar fetor evolved from the evacuations. On the following morning he was attacked with cholera, which nearly proved fatal. He proceeds: In the same detachment, a woman, anxious about the safety of her child, slept in the hospital tent, in which several choleric cases were present; in the morning she was attacked with the disease, and died. Three orderlies, also, slept in the hospital, and in the morning one of them was attacked, but recovered. "Thus it will be seen, four persons sleep in an hospital containing the infection of cholera, and that two are on the following morning attacked with the disease; whereas from the whole camp, consisting of 1500 or 1600, not five cases had occurred." "That the disease is contagious appears to have been observed by the natives themselves, and it thus commonly happens that the sick are avoided by those whose duty does not call on them to attend. A village in which cholera is prevailing is usually evacuated for a short period, until the disease is annihilated; these, and many others, are the proofs of their opinion of its contagious nature." (P. 189.)

71. Mr. Stokes, in his comprehensive report, states several well-ascertained facts, showing the infectious nature of the disease. The case of Mr. Rumbold, assistant-surgeon, is almost demonstrative of this property. He had been visiting some very bad cases, when he was seized with sickness at his stomach, and giddiness; and coming out of the tent, he fell down faint, and from that period he believed himself infected with the malady. He soon became one of its victims. The sickness and faintness with which Mr. Rumbold, in a state of high predisposition, "from fatigue of mind and body," was affected, may be easily accounted for by the information which Mr. Stokes gives in the following page. He states, that in the worst cases "a peculiar and offensive fetor was observed to issue from the body, particularly when it was covered with much sweat; it was very disagreeable when first perceived, and seemed to hang about the nostrils, exciting, long after, an unpleasant sensation." (P. 211.) In another place, he remarks, "It was found among many who came to the hospital, that some time previous to their being attacked, the disease had existed in the family to a greater or less extent, or some one branch had been ill or died of it. In others, it had spread progressively through the whole, or nearly; and among those who officiated as orderlies or attendants at the hospital, several were attacked, and some died." (P. 217)

72. Mr. Patterson observes as follows: "I feel convinced that a corps on its march, catching the exciting cause, will carry it along with the corps for weeks, and to a very considerable distance. Let this corps be halted on the finest spot of ground possible, let healthy corps join this, at short and regular intervals, and I feel convinced the disease would attack those healthy corps in a few days, and according to their respective arrivals. If this be not contagion, I do not know what name to give it." (P. 224.)

73. Dr. Daun, while he refrains from giving any opinion as to the contagious nature of the disease, states the following facts in proof of it: "On the 10th, when in attendance on O'Brien, I became indisposed in such a way as to lead me to apprehend an attack of the epidemic. On the 12th, Mr. Gray was attacked, after having been up part of the night with Thomas Flannigan. Mr. Gray was, during his illness, constantly attended by lieutenants S. and M'D., who have since had both of them attacks of the epidemic, and no other officers except them at this station have been attacked." (*Op. Cit.*, p. 273.) And, lastly, as respects the official reports, Mr. Kellie furnishes both facts and arguments, many of them similar to those already adduced in support of the infectious character of the pestilence. (P. 68–77.)

74. The above evidence I consider amply sufficient to prove that the disease, even from the commencement of its ravages, evinced unequivocally infectious properties. If my limits would permit, I could also demonstrate from the same sources that the eyes of many were shut, by previously entertained dogmas on the subject of contagion, against this property; and that several, even where they were arguing against its existence, were actually adducing important facts in support of what I have been cautiously led to believe, namely, that the disease manifested a tendency to propagate itself by means of a morbid effluvium exhaled from the bodies of the affected, similar to what is evinced by measles, and fevers whose infectious properties have been well ascertained and generally admitted.

75. It appears extremely singular that, notwithstanding the evidence which has been now quoted, in the very words of the reporters to the different Medical Boards, no means of preventing the propagation of the malady were resorted to during the number of years it has existed in the East. Surely the doubts even of the skeptical ought to have led to a careful inquiry; and most certainly the natives of the country, and the European population under the British dominion, had even a *right* to expect that those placed to watch over their health, and to devise measures for its preservation, would have attended to the unequivocal opinions expressed by a number of the best-informed medical officers in the service; and that, although a great difference of opinion existed among them, this very circumstance should have led to more intimate inquiry and a careful sifting of the truth. At all events, the error—if error it could be called—should have been on the safe side; and the Medical Boards, superintending surgeons, or others to whom the duty appertained, should have pointed out the importance of preservative measures to the government, and to civil or military officers placed over districts and corps, and have adopted the suggestion of one of their most able medical officers, who has stated the following in one of his reports to the

Madras Board: "Whether or not the disease in question be contagious is a subject of infinite importance; but where the slightest gleam of doubt obtains, it is surely better to adopt the means usual for the purpose of preventing its propagation, by appropriate *quarantine* of troops on the line of march, by preventing their immediate entrance into stations when under the influence of cholera. By these precautionary measures, I conceive it possible to preserve the lives even of thousands of individuals." (P. 189.) That no precautions of any description were taken in India to prevent the propagation of the disease, may be stated without any reservation; and hence, most probably, the reason of its extension over so very large a portion of the whole globe.

76. Before leaving this part of the subject, it may be as well to take a hasty glance at the opinions expressed by some other authors who, having observed the disease in India, have written respecting it. Mr. Orton, who published at an early period of the epidemic an able work on it, referred it to electro-aerial influence. He now states his belief in its infectious nature. Mr. Annesley expressed himself in his publication against the doctrine of infection, and imputed the disease to a similar state of the air to that assigned by Mr. Orton, without being able to point out in what this state consisted. But "de non-apparentibus et non-existentibus eadem est ratio." Mr. Annesley, however, appears not to have directed that attention to the subject of infection in relation to the disease which would impart much importance to his disbelief in its existence. In proof of this, I may merely refer to the circumstance of his quoting the letter of a correspondent, containing the following remarkable proof of infection, without adding any explanation or remark: "We have, however, been particularly fortunate till our arrival at this station, not having lost a man, or having one seriously ill, though we had been under canvass above five weeks. We fell in with a battalion of native infantry who were suffering from cholera; the next day six Europeans were attacked, the number increased daily, and most of the first cases proved fatal." Dr. Kennedy, from extensive experience of the malady among both native Indians and Europeans, states facts and arguments in proof of its infectious nature, and he justly places particular stress upon the peculiar odour exhaled from the bodies of the affected, as indicating the generation of a principle calculated to propagate the malady.

77. I have now shown, from the chief sources, that the disbelief of infection, in respect of the pestilential cholera, was not general in India; that the productions which issued from the three Medical Boards very strongly favoured, and, indeed, proved the existence of this property; that two out of the three actually insisted upon the activity of its influence; and that, therefore, the dangerous opinion, so very generally propagated, and even acted upon, both in this and foreign countries, that the authorities in India did not consider the disease infectious, is entirely without foundation in truth.

78. The identity of this pestilence with that which has ravaged the East has been proved, and, indeed, is scarcely anywhere called in question. Some authors have supposed that it has acquired new properties and characters since its first appearance and early prevalence in India, and that its infectious property is one of these. But I am entirely convinced that this is not the case. Even varieties of the disease cannot be admitted; for it is essentially the same, presenting merely gradations of intensity, and modified effects according to these gradations.

79. Several writers have supposed that the disease has originated in a number of distinct and far distant places from those causes to which the disbelievers in infection altogether impute it, and to which I shall direct a brief attention (§ 97, *et seq.*); and that it has, owing to the combination of those circumstances and causes which are generally admitted to be productive of infection, assumed this character; or, in other words, that the malady was not originally infectious, but that it has had this property superadded to it from the circumstances of imperfect ventilation, neglect of cleanliness, and crowding together of the sick. There cannot be the least doubt of those being fertile sources of an infectious principle, and that they tend greatly to aggravate all diseases, whether infectious or non-infectious; but I have remarked, in the course of my inquiries, and of my personal observations, and in the accounts of various observers, that the propagation of the malady from the affected to the unaffected frequently took place, although not to the same extent, or with the same malignity, in open, and airy, and thinly-inhabited situations, and during opposite states of the atmosphere as respects both humidity and temperature.

80. I shall next adduce proofs of the infectious nature of this pestilence in other parts of Asia, in Europe, and elsewhere. But I shall be very brief, because, the identity of the malady in both hemispheres having been fully and generally admitted, and its infectious nature in India having been completely proved, it must necessarily possess the same character in Europe, unless counteracted by powerful means; and, therefore, a minute detail of facts is not required. Several authors have insisted on the proofs which have been furnished of the introduction of the disease into the Isle of France by the Topaze frigate, and the circumstance of about 20,000 of the inhabitants having been seized with it, above two thirds of whom died, no precautionary measure having been resorted to; but that when the malady had been propagated to the adjoining island of Bourbon, a sanitary cordon was established, and only 256 persons were attacked. When the disease appeared in Aleppo, in 1822, the French consul, M. De Lesseps, convinced of its infectious nature, placed himself, his family, and all those who wished to join him, in strict quarantine, in a place adjoining the town. This colony, consisting of about 200 persons, remained perfectly secure from the disease, although 4000 persons died of it in the city. If it proceeded from some unknown state of the air, as supposed by the anti-infectionists, to what cause can we impute the escape of those who had so secluded themselves, for they surely must have breathed the same air as those who were affected? M. Hubenthal states, that a peasant having arrived from Arkatal, on the borders of

Persia, at the village of Neskutshne, to visit an uncle, was seized, the night of his arrival, with the disease. The persons engaged in restoring the heat of the body by frictions, &c., four in number, were attacked on the following day, and three of them died. Precautions were taken by the police to arrest the progress of the pestilence in the village, and it spread no farther. If the causes of the seizure had existed in the air, or state of the locality, how came all the inhabitants, excepting those who had been exposed to the inhalation of the effluvium from the affected person, to escape?

81. According to the reports of the Medical Board of Ceylon, the disease made its appearance in 1819, in Jaffnah, in Ceylon, imported from Palamcottah, with which Jaffnah holds constant intercourse, and thence it was propagated over the island. In August, 1820, the Leander is stated to have called at Trinquamalee from Pondicherry, and to have landed several of her crew affected with cholera. Trinquamalee, soon afterward, was infected, and the pestilence was again propagated over the island. The Island of Sumatra was believed to have been infected in 1819, from the intercourse carried on between Achem and Malacca, across the intervening strait; and it seems to have reached Penang and Singapore towards the end of the same year, in the same manner. Dr. LABROSSE states that the prisoners in the jail of St. Denis, in the Isle of Bourbon, who were employed in the removal of the dead bodies, all died of it; that, at the lazaretto, two servants alone escaped; and that in the hospital it was communicated to the attendants and other patients. M. MOREAU DE JONNES states that it was imported into Muscat, in Arabia, by the English East India ships; and Dr. SALINAS says that it was carried into the port of Bassorah, in 1821, by a vessel from India, and that it spread from this port, extending from town to town, even as far as the coast of Syria. When the pestilence reached Manilla in 1820, where it was believed to have been imported by ships whose crews had been, or were infected, those vessels in the harbour which abstained from intercourse with the shore entirely escaped. At Bankok, the capital of Siam, it was said to have been introduced by the ships trading there from British India. It was supposed that 40,000 persons were attacked in this city and vicinity. Its appearance in Java, in 1821, was likewise considered to have been owing to the unrestricted intercourse of infected vessels, particularly the junks trading to Samarang, whence the pestilence spread over the island, carrying off upward of 100,000 of its inhabitants. Its irruption in Canton in 1820, in Macao in 1823, in the Moluccas in the same year, and in various places in the Persian Gulf, and on the coast of the Arabian peninsula, was generally attributed to vessels which had arrived from infected places.

82. Dr. MEUNIER states, that at Bagdad, where a third of the inhabitants was attacked, none were affected but those who approached the sick. Dr. REIMANN says that there was not a single instance of a town or village in Russia which contracted the malady without previous communication with houses or persons affected. Drs. RUSSELL and BARRY, who were sent by the British government to St. Petersburg, in order to investigate the nature of the disease, state that the number of medical men and hospital attendants attacked with cholera in that city was extremely great, particularly in ill-ventilated hospitals; and they, as well as Dr. WALKER, who was sent to Moscow, express their belief in its infectious property. The report from these gentlemen to the Privy Council, dated the 20th of September, at St. Petersburg, has been kindly allowed me for perusal by Sir WILLIAM PYM, and it abounds in proofs, remarkably in accordance with the quotation from Mr. SCOTT's report (§ 68), demonstrating the infectious nature of the disease.

83. The director of sanitary police at Petersburg, Dr. REIMANN, after expressing his conviction that the Russian pestilence is entirely the same as that which has been so fatal in India, states that most decisive proofs have been furnished him that it has not been of indigenous production, but has been introduced by persons who have arrived from infected places on the borders of the empire. He farther states that he is convinced of its being less active and less fatal, according as the place in which it is introduced is more airy, elevated, clean, and free from the usual cause of insalubrity; while its increased fatality in low, moist, thickly inhabited, and dirty places has been demonstrated on numerous occasions. The personal and domestic cleanliness of the inhabitants has also a most remarkable effect upon the infectious property of the malady and its fatality. In proof of this, Dr. REIMANN states, that in a village almost entirely peopled by Jews, 700 deaths occurred from among few more than 800 who were attacked. These conclusions are perfectly in accordance with the laws of all infectious diseases, and are entirely such as *à priori* reasoning would lead us to adopt.

84. In September, 1823, the disease first appeared at Astracan, and the Russian government resorted to preventive measures in order to arrest its progress. Whether or not those measures were the cause of its disappearance may be difficult to determine, but it did disappear, and it was not until 1830 that it showed itself again in that city. In 1828 the pestilence broke out in Orenburg, and was supposed to have been introduced either by the caravans which arrive there from Upper Asia, or by the Kirghis Cossacks, who are adjoining this town, and among whom it was said to have prevailed at this time. During the winter the number seized was not great; but in the spring of 1829 it raged severely, and extended to the villages in the province. During its prevalence in this part of the Russian Empire, many of the physicians, who at first did not believe in its infectious properties, were induced to change their minds, chiefly owing to the circumstance of its appearing in places very soon after the arrival of persons affected with it. Several instances of this description have been recorded by Dr. LICHTENSTADT among the official documents published by him. Another circumstance evincing the infectious nature of this pestilence was the peculiar irregularity of its course; and to this may be added its extension in the lines of the principal roads and channels of traffic.

85. The introduction of pestilential cholera into Astracan, in 1830, was traced to a vessel

which arrived from Baku, a town on the shore of the Caspian, and at that time affected with cholera. This vessel lost eight of her crew on the voyage, and the sick were brought to the lazaretto; a day or two after which the pestilence first appeared in this populous town. According to Dr. Solomov, it attacked the suburhs on the 27th of July, and gradually extended to the nearest villages, and thence over the whole government. It proceeded through the Cossack stations and towns on the highway to Moscow, and up the streams of the Volga, at the mouth of which Astracan is situated. Its extension was attributed to the fugitives from the places successively attacked. After visiting the principal towns, and committing unheard-of ravages on the high roads to Moscow, the pestilence reached that city at the end of September. Towards the end of 1830, or soon afterward, a body of troops from Koursk, a province at that time affected with the pestilence, was marched against the Poles. These troops carried this scourge along with them, affecting the places in their line of march through Podolia and Volhynia. In this way the towns of Astrog, Zaslaf, and Luck became infected; and from the last of these places the disease passed the Bug into Poland. Here it appeared with the invading Russian army, and was communicated to Lublin, Siedlec, Praga, the Polish army, and Warsaw.

86. The following is an extract from a letter written by a clergyman, who witnessed the disease in Saratoff, and published in the *Quarterly Review* for November, 1831: "Scarcely had we heard of the breaking out of cholera in Astracan, than the news came to us like lightning that it was coursing the Volga, and that it was severe, and had already reached Zaretzin. Without a dread of the presence of the angel of death, the vice-governor, the medical inspector, and the government as well as the hospital surgeon, at once went into the infected places of this province. On the evening of the 6th of August we heard that three persons had been seized with cholera who had left Astracan, and were carried to our hospital. On the 7th, others were reported to have been carried off by this malady with such frightful rapidity as to have impressed all minds with deep consternation, especially those who dwelt in the second division of the town. The disease soon appeared in the third division, and seized so many that the hospital could no longer contain the sick, and killed so rapidly that they scarcely survived six hours. The evil came so suddenly on us, that we had no time for taking precautions; our governor and our surgeons were gone to meet it afar off, in order to preserve our city, but it was already among us before any regulations could be made, or any means of opposing it could be devised. It could scarcely be reckoned an epidemic, depending on some change in the atmosphere, for many places were left untouched in our neighbourhood, while in Saratoff there was scarcely a family who had not to lament the loss of some of its members.

87. "In the very commencement of the epidemic, all our four surgeons were seized with it; two died on their journey to Zaretzin, and one here. From this moment fear and anguish took possession of the public mind. They who could flee from the city, fled; and, as the malady was not considered contagious, servants, labourers, Tartars, and Russians were permitted to rush into the country. My congregation, which consisted of 550 individuals, was reduced to 150. Many of the fugitives died on the road, and spread the malady whithersoever they went. From the 10th of August the malady increased in virulence; the daily mortality of 4 rose to 5, 12, 20, 80, 120, 200, and one day to 260, and decreased in the same gradual mode. Up to the 30th of August, 2170 persons died. While all around was infected, Sarepta, in which the quarantine regulations were most strict, escaped, and yet this disease is not called contagious."

88. From among other evidence—indeed, I may say a mass of evidence—that furnished hy Dr. Reimann, of St. Petersburg, as to the extension of the disease through Russia, may be adduced: "The cholera was brought to Astracan by ships, and it has spread itself over Russia from Astracan by the emigration of the inhabitants, principally those of the lower orders. This is the chief cause of its propagation in Russia; it has never shown itself in any place except where it has heen brought hy travellers who came from infected places. *We have not a single instance* of a town or village which, without communication with houses or persons affected, has contracted the disorder. Several places surrounded hy the disease have preserved themselves from it by a rigid insulation."

89. The introduction of the pestilence into St. Petersburg is referred by Drs. Barry and Russell to the arrival of vessels from places on the Wolga where it prevailed. In that capital the infectious nature of the disease was shown, not only by the mode in which it was propagated in various quarters, and by its introduction into, and extension through, the prisons and hospitals of the city, hut also by its exclusion from some places by a rigid insulation. Among numerous other instances the following may be mentioned: Up to the 13th of July, fifteen hospital physicians were attacked by the disease; and "the proportionate number of attendants of all descriptions on the sick who have been taken ill with cholera is fully greater than that of the medical men." "There were 150 pupils on the officers' side (Military Academy at Cronstadt), which is kept perfectly distinct from the school for petty officers and sailors. The gates were shut on the 19th of June, and as strict a quarantine as possible maintained to the 6th of August (O. S.). No case occurred among the pupils, who are from nine to twenty years of age."

90. In a letter from Dr. Russell (*Medical Gazette* for Novemher 11th, 1831), the following remarkable fact is communicated: "The son of a villager in the government of Pensa, who was coachman to a nobleman at fifty versts' distance, died of cholera; the father went to the place to collect the effects of the son, and brought home with him his clothes, which he put on and wore a day or two after his arrival at his native village. He was shortly thereafter seized with cholera, and died of it: three women, who had watched him in sickness, and washed his body after death, were also seized, and died of the disease. The doctor arrived in

time to see the fourth case; and, finding that the disease spread on that side of the village, he had the street barricaded on the side where it had not reached, and interdicted all communication to the two sides of the village. In that side in which the disease first broke out, upward of 100 cases of cholera occurred, of whom forty-five died, but it did not appear on the other side of the barricade." And Drs. Barry and Russell report, that "the Navarino corvette, Captain Nachinoff, 200 men, had been placed two miles to the eastward of Cronstadt during the epidemic, to question and examine all craft from St. Petersburg. She had eleven severe cases of cholera, of whom eight died. Her first and second cases occurred on the 26th of June (O. S.). These two men belonged to the boat that examined the vessels coming from St. Petersburg, on board many of which they had been. The next men who fell ill were of those who carried the two first cases to the hospital in town." These are but a very few from the many facts of the same description now before me.

91. With regard to the appearance of the disease in Berlin, the following extract of a letter from Dr. Becker of that city, dated the 29th of September, 1831, furnishes information: "I am a most decided contagionist, and it is the force of facts which has made me so; for on the authority of your Indian practitioners I formerly believed the cholera not to be contagious. The appearance of the disease in Berlin, and the manner in which it has spread, is also very remarkable, and affords supplementary evidence in favour of contagion. The conclusion at which I have arrived is, that the *efficient* cause of the Asiatic or malignant cholera is always a virus, the production of *human effluvia*, and which, according to common medical language, undoubtedly deserves the name of a *contagious principle;* but that this virus, in order to produce the disease, requires, first, like the contagion of the small pox, measles, typhus fever, and even the plague, a disposition of the atmosphere favourable to its development; and, secondly, a peculiar disposition of the animal economy in every person who is exposed to it. This disposition appears to be brought on by previous disease, particularly bowel complaints, by excessive fatigue, cold, errors in diet, drunkenness, fear, &c. One young physician has been one of the first victims of the cholera, a decided anti-contagionist; he carelessly exposed himself, died, and, as if his case was to be a warning proof of the fallacy of his opinions, his death was immediately followed by that of his landlord and two children, and the illness of the servant-maid in the house, the only instances of the disease in that street." In a report subsequently given by Dr. Becker (*Medical Gazette*, 12th of November, 1831), it is stated distinctly that the disease was introduced by the vessels navigating the River Spree, which runs through the city.

92. The introduction of the disease into this country was certainly owing to the clothes and bedding of sailors, who died of it at Riga, and other northern continental ports, or during the voyage from these ports, having been too generally preserved and delivered up to their friends, upon the return of infected vessels to British ports. Of this fact, already adverted to (§ 16), several proofs of an incontrovertible nature were furnished me by two masters of vessels, on board of which several cases of cholera occurred during the voyage from infected ports. These masters were at the time, conformably with the then prevailing opinion, persuaded that the distemper could not be propagated by the clothes of those who had died of it; but facts soon afterward occurred which demonstrated to them the propagation of the malady in this manner as well as by direct communication with the affected. Soon after the opening of the first cholera hospital in the vicinity of London, near Bermondsey, I passed a considerable time with the patients first admitted, and was present during the inspection of two fatal cases. I drove thence in an open carriage, and saw two relatives, residing in an airy situation in Pentonville, a distance of from three to four miles; and yet the persons whom I visited, after so long a drive in the open air, complained to me, instantly upon my entering their apartment, of the offensive odour which proceeded from my clothes. I was cautious in not mentioning the source of this odour, and no suspicion was entertained by them of the cause. But the following day I was called to them, and found them both in an early stage of the distemper, from which they ultimately recovered with difficulty. Precautions were taken against the farther extension of the malady in this house, and no case occurred in the vicinity until some months afterward. Other proofs of infection occurred to my observation; but it is unnecessary to advert to them at this place. I shall hereafter state briefly the conclusions at which I have arrived after the closest attention I could devote to the subject.

[There have been various hypotheses suggested in relation to the nature of the agent to which cholera owes its origin, each of which numbers its ardent supporters, and is maintained with all the array of facts and arguments that can be summoned in its defence. Some, for example, regard the disease as entirely atmospheric, depending on changes in the ponderable or imponderable elements of the air, without the addition of some new ingredient. Others, again, consider the materies morbi to be a modification of vegetable miasma, produced by peculiar causes of heat, moisture, &c, acting on the productions of the soil. A third sect believes that the agent is some latent matter, evolved from the crust of the earth, and produced by volcanic and other changes, according to the views of epidemic causes, as laid down by our countryman, Noah Webster. Another party, still, regard it as strictly an agent, depending for its spread, like the virus of smallpox, on *canine rabies*, or direct contagion; understanding by this some morbid element eliminated from the human system, and propagated by actual contact or close proximity. This party, of which Dr. Copland may well be regarded as the leader, believe that other causes, such as endemic influences, atmospheric vicissitudes, &c., have but a limited effect, and are not essential to the development and action of the *materies morbi*. Its transmissibility, if they are to be believed, is only possible through human intercourse. Lastly, Dr. Holland and some others have attributed the origin and spread of cholera to *insect life*,

existent in the atmosphere under certain circumstances; while others, still, have traced it to eating bad *rice*. Every medical man who has devoted any attention to the subject must be aware of the numerous and almost insurmountable difficulties with which it is beset. The agents about which we are inquiring are subtile, invisible, uncognizable by any methods known to science. We are able to form but very vague conceptions of the various conditions in which the bodies receiving these agents are placed, either by changes in themselves, or by physical alterations in surrounding media. Anomalies meet us on every hand; and when we have flattered ourselves that we have arrived at a general law, we unexpectedly find so many exceptions that we are obliged reluctantly to abandon it, and seek for another. The views we shall take of this disease, as well as of yellow fever, may not find favour with the advocates of either of the exclusive hypotheses above mentioned, but as they are those which we honestly entertain, after a careful investigation of the subject, we shall proceed to state them as briefly as we are able.

I. The disease—we speak of it as it prevailed in this country—was essentially *atmospheric*; in other words, it was an epidemic, depending chiefly on certain unknown atmospheric causes for its extension.

This is proved by its history and progress. In the fall of 1831, influenza prevailed to a great extent, appearing first in November and continuing until January, 1832, proving very fatal to the old and infirm. This complaint was characterized by very great irritability of the digestive organs, so that antimonials and purgatives were badly borne; and the scarlatina, which prevailed during the same season, was marked by the same intestinal irritability, and often presented instances of collapse and unexpected death, similar to what was afterward observed in cholera. Cases, also, of cholera morbus, and dysentery of an aggravated type, were extremely common during the winter, many of which terminated fatally. The common cholera, which is generally endemic in Montreal in summer, made its appearance in April. Diseases throughout Canada and the United States were characterized by a low typhoid type, essentially different from that of former years.

The epidemic cholera first made its appearance on this continent at Quebec, on the 8th of June, 1832, when eight cases occurred, and fifteen on the subsequent day; and so rapid was its stride that it reached its acme on the 15th day of June, seven days after its first appearance. During the latter part of May and the first week in June, according to Dr. Robert Nelson, diarrhœa was a common and predominant symptom in every form of disease that prevailed at Montreal; and on the ninth of that month cholera, in an epidemic form, burst upon that city; and so rapid was its progress, that in nine days it reached its height, a fact, perhaps, difficult to explain upon the doctrine of contagion alone. The same intelligent physician informs us that, during the same night of its first appearance, it attacked numerous persons, in various parts of the city, remote from the port and from each other, and having no communication with the port or place of landing. In two weeks eight hundred persons had died of it. It continued its progress from one place to another, along the St. Lawrence and the lakes, outstripping the progress of travel and emigration, and appeared in Detroit early in July. With respect to the appearance of cholera in Quebec, which Dr. Copland says was conveyed in an emigrant ship (§. 17), it was stated in the Quebec Mercury, at the time, and the statement was afterward confirmed by the testimony of the most respectable physicians of that city, that, although the first cases were among emigrants, all attempts to trace it to any vessel had been unsuccessful, and that the sickness on board the Carrick and other vessels suspected, was ship-fever, small-pox, &c. In the first two weeks of its prevalence there were one thousand deaths.

The cholera first appeared in the city of New-York on the 26th day of June. The patient, an intemperate Irishman, had not been out of the city for some weeks, but was attacked after a debauch and falling into the dock. He came under our care, and died at the medical mansion in Greenwich, more than two miles from the place (Cherry-street), where other cases occurred the ensuing day.—(See *Commercial Advertiser of June* 28–9, 1832.) The disease reached its climax in this city twenty-seven days after its commencement. The disease broke out at the almshouse establishment at Bellevue soon after its first appearance in this city, 27th of June. The patient first attacked had not been out of the house for some time previous, and of course could not have been exposed to any foreign causes of the disease. The same remark will apply to its first appearance among the inmates of the state prison at Sing Sing, where it broke out on the 17th of July, and proved extremely fatal. We are authorized in stating that the disease originated in the establishment, not only from the rigid discipline which is there enforced, and which renders it highly improbable that any foreign communication should take place which could escape detection; but especially from the testimony of the superintendent and physician of that institution that the disease was not introduced from abroad, but originated within the prison.*

It is worthy of remark, in this connexion, that the cholera made its appearance in New-York sixteen days after the first case occurred in Quebec, and without having shown itself at any intermediate spot between Canada and this city, all the intermediate cities on the sea-board of the provinces of New Brunswick, Nova Scotia, and of the states of Maine, Massachusetts, and Rhode Island, remaining wholly exempt. The first case of the disease at Albany occurred on the 3d of July, having been preceded for weeks by the general prevalence of diarrhœa.

According to the best authorities, the first case of the disease in Philadelphia was observed as early as the 5th of July; but, according to Professor Jackson, it did not assume an epidemic form until the 27th of the month, when the epidemic influence acquired its full sway,

[* See *Reports of Hospital Physicians and other Documents in relation to the Epidemic Cholera of* 1832. p. 26. (Published by order of the New-York Board of Health, 1832.)]

and cases were daily developed. The epidemic obtained its acme about the 6th of August, from which time it rapidly declined. "Taking the 27th of July as the proper commencement of the epidemic," says Professor J., "in Philadelphia, and the 1st of July as the same epoch in New-York, we have twenty-seven days for the transmission of the epidemic. The distance in a direct line is between eighty and ninety miles." (*Am. Jour. Med. Sci.*, vol. ii., p. 291.) The same writer remarks, that "the routes or lines of communication leading from the St. Lawrence to the United States do not appear to have been the means of conducting it into our territories, or infecting our cities, notwithstanding the number of emigrants and others who penetrated into the country in those directions."—(*Loc. cit.*) The cholera did not make its appearance in Boston until about the middle of August, and then only in a sporadic form; the whole number of cases of it, as stated in the annual report of deaths, being 78.

During the same month it appeared at Baltimore, Washington, and various other places in the United States. About the 1st of October it suddenly broke out at Cincinnati, and nearly at the same time at Madison, Louisville, and St. Louis. It reached New Orleans late in the month of October. Leaving the Ohio, it visited Tennessee, Illinois, Indiana, and Kentucky, Lexington, Maysville, and other towns suffering very severely.

It would not be difficult to show that the cholera appeared in many places besides those above mentioned, without the possibility of tracing it to any foreign source, as at Grenville, on the Ottawa River (C. E.)—(*Bost. Med. and Surg. Jour.*, vol. ix., p. 55.) Such are some of the reasons which induce us to believe that this disease was an epidemic depending mainly on some unknown distemperature of the atmosphere, whose laws have never been satisfactorily investigated or explained.

II. Cholera is, under certain circumstances, hereafter to be pointed out, *contagious* or *infectious*; using these terms, with Dr. Copland, as synonymous. We see no incompatibility whatever in attributing its spread to both of the abovementioned causes, and we think that physicians have unnecessarily taxed their ingenuity in attempting to limit its spread to a single cause. All admit that the *typhus* or *ship* fever is generated by confining many persons in a small compass without due regard to ventilation, cleanliness, and proper food, and that it is, moreover, *contagious*; that is, capable of propagation to those who have not been under the influence of the same predisposing causes. Scarlet fever, measles, and hooping-cough are instances of epidemic diseases, being also propagated by personal contagion, while they owe their origin and general prevalence to some unknown constitution of the air. Cholera, yellow fever, and plague belong, in our judgment, to the same category. It is idle to attempt to account for their spread upon one principle only. There is nothing, moreover, *unphilosophical* in our position. *One cause*, doubtless, might be sufficient to produce equally devastating effects; although we know of no simply contagious disease which bears any analogy in its rapidity of extension and fatality to that of cholera; but the question at issue is, are the facts of the case reconcilable upon either hypothesis singly? We repeat that they are not. In the operations of nature, we not unfrequently find the same results brought about by several causes; as heat and light by the rays of the sun, by friction, and electrical and chemical action. We shall quote a few examples, where the disease was propagated, beyond all question, by contagion.

On the 31st of October, 1832, the brig Amelia, bound to New Orleans from New-York, was wrecked on Folly Island, about twenty miles from Charleston. Some of the passengers laboured under cholera, which prevailed at New-York when she sailed. They were all landed safely, and lived in the few buildings on the island and in tents. There they continued to sicken with the disease. A boat's crew of wreckers had gone to the stranded vessel to save her cargo, and, on their return to town, one was seized with cholera and died. The rest of the crew were ordered to the island to perform quarantine with the persons landed from the brig, and one was taken on his way and died in the boat. There were four negroes on the island. Three physicians were sent from the city to attend the sick, and a detachment of the city guard was detailed to enforce the quarantine. Of the wreckers, thirteen in number, several were attacked, and eight died of cholera. One of the physicians was seized with it, but recovered. The nurse of the wrecker, above mentioned as dying in the city, himself sickened and died, after being sent to the island. Of the four negroes residing there, three died; of the guard sent down, eighteen in number, ten were sick, and one died.*

On the 17th of July two females left New-York in a packet for Newport, where they arrived well the next day. After being detained a week at quarantine, they were permitted to land on the 25th. They were both sick with cholera when they landed, of which they both died on the same day. On the 30th, Mr. Foster, who had assisted in burying them, was attacked with the same complaint, but recovered. Immediately after this his wife and three children were attacked with cholera, of whom the wife and two children died. (*Reports on Cholera*, &c., N. Y., 1832, p. 19.) The disease was also communicated to two persons at the hospital, where two of the above patients had been removed, both of whom died. The town of Newport was, at this time, perfectly healthy, and there was no ground to suspect the operation of any general or local cause.

Dr. Ellwood, of Rochester, states that a man who had attended some friends sick of cholera in that city, went to Mendon, a small village sixteen miles east of that place. He died of cholera the following night. There had been no case of the disease there before this. Of six persons who attended him during his sickness, and buried him, not one escaped an attack, and four died within a week. There were afterward thirteen deaths by cholera in a population of only one hundred and fifty persons. (*Loc. cit.*, p. 20.)

At Manchester, Ontario county, New-York, a similar fact was observed. A lady arrived there, and died five days after leaving New-

[* *Essays on Pathology and Therapeutics*, &c., by Samuel Henry Dickson, M.D., vol. xi., p. 92.]

York. Her sister, who resided at Manchester, and was with her during her illness, died two days after. (*Loc. cit.*, p. 20.)

In Oneida county, New-York, some Indians were employed to bury a person who had died of cholera in a canal-boat, six of whom died of cholera very soon after. In all the above instances there had been no cases of cholera previously within many miles of the places mentioned.

The above, and numerous facts of a similar kind, oblige us to adopt the doctrine of contingent contagion, with the full conviction, moreover, that contagion *per se* is utterly inadequate to account for the phenomena attending the prevalence of this disease. It is a malady, we believe, propagated, as a general rule, by other agency than that of reproduction by the human system; and yet at times, and under particular circumstances, by no means fully understood, it is so reproduced, and acquires contagious or infectious properties, so called. At any rate, the fact has been, in our judgment, fully established that the disease cannot be localized and restrained by quarantines; theory and experience both demonstrate the inutility of preventive measures of this kind. The cholera is contagious just as typhus fever is contagious, in crowded, unventilated dwellings, amid filth, intemperance, and poverty; rarely in cleanly, airy apartments, the inmates of which are regular and temperate, well-fed and well-clothed.]

93. ii. *The Infection of pestilential Cholera, assisted by predisposing, concomitant, and determining Causes.*—It may be briefly premised, that this disease is never produced without the presence of a certain leaven, or morbific matter, which, emanating from the bodies of the affected, and floating in the air, is respired by those about to be attacked. This is the clear and only inference connected with its transmission that can be deduced from the body of evidence now placed before the reader. Those who argue against its transmissible nature cannot show, since the irruption of the pestilence in India, down to its arrival in this country, and transmission thence to America, a single instance of its appearance in any place without the previous communication with an infected place or persons, of a nature to propagate the malady.* The non-infectionists place great reliance upon the circumstance of the disease having, in several places, spared a large number of those who have come within the sphere of its influence. But they must be aware that a similar circumstance is uniformly met with during the prevalence of all diseases acknowledged infectious. All who are exposed to them are not equally, and many are not at all liable to be affected by them; and the person who may not have been susceptible of the infection to-day may be susceptible to-morrow, owing, very frequently, to the causes about to be noticed. This pathological fact is familiar to every observer in respect of smallpox, measles, scarlet fever, and the true typhus—diseases whose infectious nature is very generally admitted; and wherefore should it be otherwise in respect of the present pestilence? The same fact, moreover, has been remarked of all pestilences of which we have any accurate information in medical annals. In illustration of this I may notice what has fallen under my own observation. During the dry easterly winds which occasionally prevail on the west coast of Africa, it is frequently impossible, and always difficult, to infect the system with smallpox, even by inoculation; and when the operation succeeds, the disease is usually mild and the eruption distinct; whereas, during the moist, close, and sultry weather following the rainy season, it spreads with the utmost rapidity; the effluvium from the bodies of the affected appears to be carried to considerable distances, and transmitted readily by means of various media, the disease being generally confluent, and most fatal.

94. The circumstance of so many persons escaping, besides being referable to this non-predisposition, may likewise be explained by the circumstance of free ventilation, the perflation of currents of pure air, by modes of living calculated to oppose the invasion of the infectious effluvium, and by being habituated to the influence of this principle. We frequently observe that persons constantly present in places contaminated by an infectious effluvium are less liable to be attacked than those who are suddenly introduced from a purer air, but at the time predisposed to infection. This has often been demonstrated by the experience of others as well as of myself. Thus, on the first occasion of my visiting the cholera hospitals and cases of the disease, a sensible effect was produced upon my respiration, pulse, and digestive functions, that was less and less manifested on each successive exposure to the concentrated emanations from several of the sick placed in one apartment. A similar fact was observed by others; and, although it was very remarkable in this distemper, it has also been noticed in respect of other infectious maladies. Thus, a person confined in a close apartment with the true typhus fever was visited by a friend; the visiter, upon entering the apartment, [smelt] a peculiar, disagreeable odour, which occasioned a slight faintness and nausea, followed by headache, indisposition to action, &c. This slight indisposition continued for several days, when, about eight or nine days afterward, typhus fever was fully developed. The person thus infected was kept in an airy apartment, and directions given as to ventilation, &c., with the view of preventing its extension; and the means employed succeeded as far as regarded the members of the family; but, when convalescent, a friend was admitted, and this person caught the disease. What the ultimate progress of the malady was in respect of this third person I had no means of knowing; but I have no doubt that the disease was communicated, in these two instances, if not in the one first referred to, while none of the constant inmates of the families were infected.

95. Another circumstance showing the operation of a specific cause in producing the pestilence is its uniform and specific character in all climates, seasons, and localities (§ 112). [The cholera is no more specific and uniform in its character than many diseases acknowledged to be epidemic, and caused by some conditions of the atmosphere.] If the efficient

[* This statement can by no means be borne out by facts as observed in this country.]

causes of the disease were diversified, or consisted of the contingent combination of several, we should naturally expect a similar diversity of effects and a constantly-varying malady, both at its commencement and during its advanced progess; but such has been shown not to be the case (§ 53, *et seq.*). The efficient cause is specific, the disease itself is specific, and only modified as respects severity or grade, and the manifestation of certain subordinate phenomena, by the intensity of this cause, by certain predisposing, concomitant, and determining influences, and by the habit and temperament of the affected (§ 97–101, *et seq.*).

96. Having stated that the pestilence is not communicable to any excepting to those who are circumstanced or disposed so as to allow the invasion of its exciting or specific cause, it will now be necessary to notice those circumstances which co-operate in this manner; and this is the more necessary, as those who deny the infectious nature of the disease refer it altogether to certain influences which *predispose* the frame to the action of the specific cause, which re-enforce or *accompany* it, or which, owing to their presence *after* exposure to it, determine its operation, or bring it more rapidly or more efficiently into action, when it might otherwise have failed of its effect.

97. Many of the earliest reporters and writers on this pestilence, who disbelieved in its infectious nature, had recourse to the state of the seasons in India to account for its occurrence. Some referred it to the prevalence of easterly winds, with long-continued or heavy falls of rain, by which the air was rendered moist and vitiated; others, to sudden or extreme variations of the electrical conditions of the atmosphere, which variations were mere suppositions, and not matters of corroborated observation; not a few, to the extrication of some peculiar terrestrial miasm, projected in distinct or remote places from one another, and proceeding in singular currents, so as to involve a part of a village, or a detachment, or even company of a regiment, while the vicinity was intact; and several could detect no other cause for it but exhalations proceeding from low, moist, and swampy situations, and other sources of malaria, rendered peculiar by some unknown cause, or productive of this peculiar disease from errors in diet or incautious exposure. Now it should be kept in recollection that the existence of all, or any of these, was merely suppositious; that proofs were never adduced, and that the commonest meteorological observations were generally wanting. There was no uniform relation observed, either in this country or in the eastern and western hemispheres, between the appearance of the malady and marked variations in the barometer, thermometer, or hygrometer, even in the few places where these were registered; but the irruption of the pestilence was often observed in states of season, weather, and atmosphere opposite to those to which it has been confidently imputed. Even admitting that all the above-mentioned causes were actually in existence (and I believe they were frequently present), particularly during the severer irruptions of the disease, they merely show the truth of a part of my doctrine, viz., that the infectious nature of the disease was more strikingly evinced during conditions of the situation, season, and atmosphere, of acknowledged insalubrity; that whatever tended to lower the energies of the frame, as such causes indisputably do, favoured the operation of the infectious effluvium issuing from those affected by this pestilence, and rendered it more prevalent when they were concentrated or uncommonly active; and that, in this respect, as well as in many others, the infection of pestilential cholera observes the same laws as other infectious maladies, as scarlatina, measles, &c., manifesting itself in isolated cases only during healthy states of season and atmosphere, and spreading to a greater or less extent during seasons of marked insalubrity, and during peculiar constitutions and vicissitudes of the air.

98. So far, therefore, from disputing the influence of many of those causes to which some highly-respectable authors have imputed this malady, I fully admit their operation, even although their existence is more a matter of inference than of observation. I deny, however, that they are sufficient for the production of the destructive effects characterizing this pestilence, and contend that as no such effects have, in the history of our species, been known to result from them, so we cannot with justice admit that they are alone capable of producing them so as to generate this pestilence: I view them merely in the light of predisposing and concomitant causes coming in aid of a more powerful agent, which, emanating from the bodies of the affected, contaminates the predisposed in such a manner as to give rise to the same morbid actions as those which generated it; that these imputed causes favour the operation of this infecting agent, 1st, by predisposing the frame to its influence; 2d, by re-enforcing or assisting its action; and, 3d, by determining or calling into operation the infecting principle. The predisposing and re-enforcing influence of the different causes already referred to cannot be denied. We know, or, at least, observe too much of their influence in respect both of contagious and infectious diseases which are familiar to us to doubt their operation as regards this distemper; indeed, their action would be a matter of undoubted inference to the well-informed physician, independently of the results of observation.

99. But, besides the *predisposing and concurring causes* noticed above (§ 97), there are others not yet enumerated, of equal influence, not only in favouring the operation of the efficient agent of the malady, but also in calling it into action after the frame has been exposed to its invasion. The chief of these are, anxiety and depression of the mind; fear of the disease; physical and moral debility; low living and unwholesome diet; constitutional debility or laxity of the bowels; previous disorder of the digestive organs; neglect of personal and domestic cleanliness; deficient or filthy clothing; exposure to cold; the immoderate use of intoxicating liquors, or excess of any description; sleeping on the ground, or in low, ill-ventilated apartments, or in the open air; the use of cold, indigestible, or unripe fruits; cold drinks when the body is overheated; fatigue; sudden arrest of the cutaneous exhalations, however produced, &c. Either of these, whether acting shortly before, or at the time, or even

soon after the body is exposed to the invasion of the infectious effluvium, will favour the production of the malady, particularly if several of them act in conjunction, and if, at the same time, those causes, whether proceeding from the state of the locality or of the air, to which allusion has been already made, are also present.

100. One of the most remarkable of predisposing causes to an attack is *advanced age*, as well as one of the most unfavourable circumstances as respects hopes of recovery. Instances of attack previously to puberty were comparatively few; but the frequency of the seizure after 40 years of age increased in proportion to the advance in age, and the mortality in a still greater proportion (*see* § 21); so that after 55 years recovery was rare.

101. It has been already stated that a great number of the medical men called upon to treat this pestilence have imputed it chiefly to atmospheric causes, denying altogether the influence of infection; and the chief arguments which they advance, in order to show the absence of this property, have been and are about to be referred to (§ 97–99, and 102, *et seq.*). I verily believe, nevertheless, that this malady is infectious in a similar manner to measles and scarlet or typhus fever; that is, not by contact, but from the inhalation into the lungs, along with the air, of the morbid effluvium given out from the body or bodies of the affected. We know that the mere contact of persons suffering from the diseases now mentioned will not communicate them even to the predisposed; while the presence in the air which is breathed of a scanty portion of the effluvium given off, during their progress, from the affected, will often produce them; and such, I am convinced, is the case with the pestilential cholera. We farther know, that it is not easy to communicate these acknowledgedly infectious diseases by inoculation when access of the morbid effluvium to the lungs is prevented. It, therefore, can be no matter of surprise to learn that M. Foy, and others of the young physicians who visited Warsaw, failed to propagate the malady by inoculation, or by tasting the matters vomited by the affected; even although the tasting matters vomited, under any circumstances, might well have turned the stomachs of many. Indeed, though cautiously convinced of the existence of the infectious nature of the pestilential cholera, I would have inferred that inoculation, or the introduction of the morbid secretions into the stomach of healthy persons, even were they predisposed to an attack of the malady, would have failed, in accordance with the laws which infectious diseases observe, to communicate it, provided the effluvium proceeding from the bodies of the affected be prevented from passing into the lungs. I as firmly believe that it is the inhalation of this effluvium into, and its influence on, the lungs of the predisposed, that paralyzes the nervous energy and functions of this very important and vital organ, occasions the singular collapse of it observed after death, and evinced during life by the state of the hypochondria, epigastrium, and respiratory organs, prevents the changes which the blood is destined to undergo in the lungs from taking place, and gives rise to all the consecutive phenomena of the attack, as I am confident of any fact in pathology.

[While in attendance upon the Greenwich Cholera Hospital, in 1832, a medical gentleman, Dr. C., from Vermont, called on me and requested the privilege of seeing some of the cases. I accordingly accompanied him through the different apartments, in which there were about 70 patients in all stages of the disease. This occupied about twenty or thirty minutes; and on reaching the door, after completing a hasty examination of the cases, he suddenly complained of faintness and nausea; in a moment more I perceived him staggering, and likely to fall. I accordingly supported him in part while he sunk upon the floor, apparently in a perfect state of asphyxia. By the application of cold water, stimulants, &c., with the aid of a horizontal posture, he soon revived sufficiently to be removed in a carriage to his hotel, where he was immediately seized with cholera in its worst form, and barely escaped with his life. This gentleman had reached town only an hour previous to his call at the hospital, had not been previously exposed to the disease, nor had he any fear of an attack. I regarded it, and still do, as a very striking example of the influence of cholera effluvium, when intense, in affecting the human system, even if not predisposed.]

102. iii. *Arguments of those who contend that the Disease is not Infectious, farther noticed.*—I have adduced above (§ 61, *et seq.*) sufficient evidence of the infectious nature of this pestilence, and have stated, under the head of concurrent causes, those to which solely the anti-infectionists impute the disease. I have now to notice, more particularly than I have yet done, certain arguments on which they rely in favour of their doctrine; and, first, they contend that, having had sufficient and admitted proof that cholera has not hitherto been an infectious malady, either as occurring in warm or temperate climates, wherefore should it change its nature, and become infectious at the present time? The ready answer to this is, that it is granted that the common cholera, whether that connected with a vitiated state of the biliary secretions, or that more severe form of the disease most frequently met with in warm countries, and denominated spasmodic cholera, or *mort de chien*, is not infectious; but that this can be no reason why this pestilence, which is distinct from cholera, occurring from other causes and under other circumstances, possessing also very different characters, among which those of cholera are merely a part, and the least important part, should present this very important feature.

103. Secondly, they contend that, if this malady were infectious, a greater number of those who come near the affected would be attacked; and because, under circumstances already alluded to (§ 93, 94, 95), so many do escape, that therefore the disease is not infectious. This is the chief argument on which Mr. Searles, referring to what took place in his own hospital at Warsaw, relies, in support of his opinions as to the non-infectious nature of the disease. But as respects the escape of a large proportion of those who are exposed to the infection, this pestilence resembles all other known infectious diseases, not excepting even the most virulent.

104. Much stress, also, has been laid upon the fact of the disease not having been communi-

cated by inoculation, and by tasting the ejections; but this proves nothing, and is merely an illustration of what ought to be known to every medical man—that diseases which do not generate a specific virus cannot be easily propagated in this way. Who, I would ask, would expect to communicate measles, scarlet fever, or typhus fever in this way? Who would expect to be affected by even a concentrated morbid virus on receiving it into the stomach? It is well known that the matter of smallpox and the poison of serpents may be thus applied without effect. That so many, or that all even, of the attendants in an hospital should escape, is only what most medical men of any considerable range of observation would expect, reasoning from their experience; this point, however, has already been disposed of (§ 93, 94, 95, 101). But the facts are, even on this point, as respects this pestilence, opposed to the doctrine of the non-infectionists; for it has been proved on numerous occasions, several of which have been noticed when demonstrating, by direct proofs, the infectious nature of the disease, that a very large proportion of the medical men and hospital attendants were attacked, notwithstanding the absence of all dread with which medical men and their attendants view disease, and their habitual exposure to animal and other insalubrious effluvia.

105. Thirdly, the non-infectionists argue that numerous instances of the true pestilential cholera have occurred, which could not be traced to exposure to communication direct or indirect with those previously affected. This may be the case in a few instances; but how difficult is it to prove mediate infection, or that which takes place through the medium of fomites; and it may be asked, on how many occasions are persons liable to be affected by an infectious principle, without being able to account for the manner in which it took place, or to refer to the individuals whence it emanated, or to the media through which it was conveyed? We know that infectious diseases may occur almost immediately after the impression of the exciting cause, or not until after many days, or even weeks, according to the state of predisposition in relation to the intensity of the cause, during which interval certain latent or almost imperceptible changes are going on in the frame; therefore, during so indefinite a period of interval between exposure to the cause and the development of disease, how can all those attacked refer to the particular occasion on which they were exposed to infection?

106. Fourthly, the anti-infectionists refer to the occurrence of epizooties, in proof of a noxious emanation from the earth, which, floating in the air, affects both man and beast, and occasions this pestilence. I grant that emanations may, and sometimes do, arise from the soil, and affect man as well as the lower animals; and that, when this phenomenon takes place, it may be a concurrent cause of the pestilence, so far as to increase the predisposition to infection, and the fatal tendency of the disease. But, from a careful review of the occasions on which epizooties have been observed contemporaneously with the prevalence of this pestilence, I can state that they have been few, and merely coincidences, which by no means affect the question at issue. It should be kept in recollection that several of the seasons preceding and during the prevalence of pestilential cholera have been usually wet, and that increased mortality among the lower animals is often observed at such times. Many even of the instances of such coincidences on record are so vague, and so deficient in accuracy of details and dates, as to deprive them altogether of importance in the discussion of the subject. Besides, during the very long prevalence of this malady over the whole globe, it would have indeed been wonderful if the coincidence of epizooties with it had not been observed.

107. Fifthly, another circumstance made use of by the non-infectionists is that of so many who have observed and treated the disease having espoused their side of the question. To this I may reply, that a very large number of those who have enjoyed this advantage have not had, even in India, as may be ascertained by referring to the reports of the Medical Boards, and to the documents at the India House, that extensive experience which we in this country suppose. It should be recollected that a large proportion both of natives and native troops were treated by their native doctors. Besides, are we to expect those comprehensive views of the history and modes of propagation of a disease from those who have seen but a little, and described only what they have seen; or from those who dispassionately investigate the origin, the causes, the phenomena, and the relation of all that has been observed and recorded, and cautiously weigh the evidence on either side of a disputed topic connected with it? The captain of a company, or even a colonel, performs an important part, individually, in an army during a general engagement; but he can know little, personally, of the disposition, changes, and evolutions of all its parts, and of the plan of strategy, according to which it first acted, or was led to change its operations, in order to meet or counteract those of its opponent. Like the commander-in-chief of the whole army, we, who collect, compile, arrange, and digest facts, on both the one side and the other of a disputed subject; who observe closely what has occurred within the sphere of our own experience; who compare, weigh, and meditate upon the whole evidence, personal as well as testimonial, with our minds uninfluenced by prematurely conceived ideas, are the best suited to investigate, and to conclude respecting them. Placed, by the number of accumulated facts, and by minds accustomed to view and to investigate the difficult operations of nature, on the elevated table-land of human science, we may be admitted to be more able to take in a comprehensive view of the causes and nature of disease, and to come to accurate conclusions respecting it, than many of those who, as observation has shown, have drawn hasty inferences from a few and very imperfectly investigated occurrences.

108. Sixthly, the non-infectionists also argue that if the disease had been infectious, its propagation would have been prevented by the measures resorted to. To this argument I reply, that the disease, during its prevalence in the East, was never expected to be confined by sanatory measures; that it was not until it reached Astracan that any such measures were

attempted, and then only imperfectly; and yet these succeeded for eight years in preventing its entrance into that place; and that, where rigorous quarantine has been adopted, the measure has succeeded, several instances of the success of such measures having already been adduced.

109. The non-infectionists farther state that several continental states and authorities, convinced of the inutility of quarantine, have relinquished it. Granting this to be the fact, it merely shows, what any thinking person must admit, the impossibility of preventing the introduction of the disease into a populous town, situate in the vicinity of others, and of a thickly-inhabited country, between which there must necessarily still be, even under the most strict quarantine, a constant intercourse of some kind or other, either by land or water, and perhaps by both. There can be no doubt, if the testimony of several well-informed persons, cognizant of the facts, are to be relied upon, that the distemper was introduced at several seaports of this country by the bed and body-clothes of those who died on board mercantile ships, that had been preserved and given up to the relatives of the deceased. But a strict quarantine and purification of these effects only could have prevented this mode of communicating the distemper; and in no instance were these observed. Indeed, many ships arrived, during the latter part of 1831, in British ports, from infected places, having lost individuals from among their crews on the voyage home, and the fact was often either concealed or not attended to, the infection either proceeding farther, or not, as circumstances concurred to favour it.

110. But let me turn for a moment to the causes which the non-infectionists substitute for an infectious principle. Some argue in favour of a certain distemperature, epidemic condition, or altered state of the air, being the cause of the disease. Now these are mere suppositions. But grant them to exist, how would they explain the progress and propagation of the pestilence? The air is a very mobile fluid, sweeping along frequently at the rate of seventeen and eighteen miles an hour, and being constantly renewed, both in a horizontal and in a vertical direction, unless in situations where it can be confined. But the disease has not been propagated in the course of winds, or with the rapidity which such a source would suggest: it has advanced slowly, and at the rate at which human intercourse takes place, in the lines or channels of such intercourse, and in the quarters where intercourse with previously infected parts has occurred. It has usually spread in a town, visited prisons or sequestered places the last, but affected them severely when introduced; and it has entirely avoided those who placed themselves altogether apart from the rest of the community.

111. If the constitution of the air were the cause, how came isolated places, in the middle of infected towns, or in the track of the progress of the disease, to escape? How could the disease be barricadoed, as it was in some towns in Russia, and shut out from certain districts and streets? How could it spread and travel along one side of a river, in the line of public intercourse, and never appear on the opposite side, or, if it did appear, wherefore did it, either first or merely, at the point where communication with the opposite banks takes place? When introduced into a country, wherefore should it break out first in seaports having intercourse with previously infected places, or in towns having inland communication with parts thus circumstanced? If the air were the source, how was its noxious property retained after passing hundreds, or even thousands of miles, as in the case of the appearance of the disease in the Isle of France; or wherefore did it, after this passage, respect the adjoining islands? How came the disease never to appear in any place without previous intercourse with a previously infected part, if it arose from a generally diffused state of the atmosphere?

112. Others, again, impute the pestilence to the exhalation from the bowels of the earth of some peculiar miasm. But the above arguments are equally weighty when directed against this supposition; for, independently of such exhalation being a mere assumption, as well as the foregoing, and putting out of the question the fact that not a vestige of evidence has ever been adduced of any peculiar change of the atmosphere from its usual condition, or of any miasm, exhaled from the interior parts of the earth, having been observed simultaneously with the appearance of the malady, these causes, even if they did exist, could not account for the specific and uniform characters which it has always presented, in every situation, temperature, and elevation above the level of the sea, in all latitudes and longitudes, and from its commencement constantly up to the present time. A distemperature of the air, whether from foreign gases, electrical states, or whatever other cause, surely could not for such a period, or under such a variety of circumstances, be so uniform and specific. Exhalations from the interior of the globe, whether proceeding from a great internal fire, from the action of circumambient agency, solar or lunar, or both, or from the electrical changes taking place in the more interior masses and constituents of our planet, surely could not, in all places, at all periods of this epoch, at all elevations, and under every combination of circumstances, be so uniform in their effects, so specific in their action, as the character of this pestilence shows its exciting cause to be.

113. If a noxious exhalation, proceeding from the more interior parts of the globe, caused the disease, it must on some occasions have risen through the depth of the ocean to have affected the crews of ships. Could this have taken place without it being changed by the medium through which it passed?

114. Where we find a distinct agency—a specific effluvium, exhaled from the bodies of the affected, of which we have certain proofs, not merely as respects the manner of its operation, but also as regards its impression on several of our senses—wherefore should we have recourse to suppositious essences and to vain imaginings to account for the propagation of the disease?

115. It may be supposed that more space has been devoted to this part of the subject than it deserves. It is, however, of the most transcendent importance; for upon accurate views respecting it altogether depends the success of

measures to prevent the extension of the pestilence, and even to remedy it where preventive measures have failed. Besides, as this pestilence is placed in the same category with true yellow fever and the plague, both by those who argue for and by those who argue against infection, the evidence for or against this property in respect of it applies also to the others.

116. Having devoted much attention to the phenomena of this pestilence, and to the circumstances characterizing the dissemination of it, and having had extensive experience in it during its prevalence in this country,* I proceed very succinctly to state the conclusions at which I arrived as to its causation and propagation.

117. (*a*) The distemper was caused by infection, which was traced in many cases—in most of those which I saw in private practice: it was manifestly infectious according to the definition I have given of Infection, in the article devoted to the consideration of this topic (see § 3, *et seq.*).

118. (*b*) It was not caused or propagated by immediate or mediate contact—by a consistent, manifest, or palpable virus or matter; but by an effluvium or miasm, which, emanating from the body of the affected, and contaminating the air more immediately surrounding the affected person, infected the healthy who inspired the air thus contaminated, especially when predisposed in the manner above shown (§ 99).

119. (*c*) This morbid effluvium or seminium of the distemper—this animal poison emanating from the infected—was often made manifest to the senses of smell, and even of taste; it attached itself to the body and bed-clothes; remained so attached for lengthened periods, if these clothes were shut up in confined places; and reproduced the disease when the air respired by predisposed persons was contaminated or infected by the clothes imbued by the effluvium or poison.

120. (*d*) The disease was thus propagated in numerous cases; and, as I was convinced in my own person, even by the clothes of the physician, without himself becoming affected. An infected or contaminated air—infected in the way just shown—caused an attack, without immediate or mediate contact, which was entirely innocuous, provided the air contaminated by the affected person was not inspired.

121. (*e*) Placing the hand upon any part of the surface of a person in the cold or blue stage of the distemper was often followed by a peculiarly unpleasant or tingling sensation in the course of the nerves of a healthy person, but this would not occasion infection, if breathing the contaminated air surrounding the affected was avoided.

122. (*f*) When the poisoned air was breathed by a healthy person for the first time—especially the unpleasant air in the wards of a cholera hospital, or that surrounding the dead body, or that contaminated by the evacuations, a morbid impression was often felt and referred to the chest and epigastrium, giving rise to frequent forcible inspirations or expansions of the chest. This impression and its immediate consequences generally disappeared after a recourse to stimuli, or full living; but were followed by some grade or other of the distemper if other depressing agents, as fear, &c., or high predisposition, favoured their development.

123. (*g*) On occasions of subsequent exposure to the efficient cause of the malady—of breathing the infected air—this morbid impression was somewhat less manifest; and each successive exposure was followed by less evident effects, unless the morbid effluvium was more concentrated in the respired air.

124. (*h*) The operation of the morbid effluvium or animal poison was violent in proportion to the concentration of it in the air respired, and to the weakness of the person inspiring it, and to the grade of predisposition.

125. (*i*) There is no evidence to account for the generation of the choleric poison in the first instance, and there is as little of its reproduction *de novo*, on subsequent occasions. It is also impossible to form a correct idea of the period during which the infectious miasm or seminium may be retained by clothes closely shut up from the air, or by the dead and buried body, and be still capable of infecting the healthy.

126. iv. *The Disease considered in relation to its exciting Cause, and the Effects of this Cause on the Vital Functions and Blood.* — The intimate relations and nature of this pestilence can only be inferred from a careful examination of symptoms or phenomena, in connexion with their exciting cause, and with its effects, both direct and consecutive, upon the frame. The uniformity of the symptoms, under every circumstance of locality, climate, and constitution of the affected, would point, as stated above (§ 53, 95), to one specific or principal cause. But in what does this consist? The manner of the attack, the selection observed in its victims, the circumstances connected with the seizure, the characteristic symptoms which it presents, and various other considerations, strongly indicate, independently of the evidence adduced in proof of it, the existence of some animal poison or effluvium proceeding from the diseased and infecting the healthy. But in what way this poison, or leaven of the disease, first originated, there are no certain data from which to venture

* On the introduction of the pestilence into this country, I was desirous of observing it in the cholera hospitals within my reach, especially in those first established; and my friends at the Privy Council Office furnished me with every facility in accomplishing my intention. I saw also many cases in private practice, both in my own vicinity and in various parts of the metropolis and suburbs.

[The editor may also be allowed to refer to his own opportunities of witnessing this disease. At the commencement of the cholera in New-York, 1832, he was appointed by the "Board of Health" to organize a cholera hospital in the northwestern part of the city, then called Greenwich, which he did, and was connected with the same during the prevalence of the epidemic. The cases treated from July 6 to September 5, 1832, were 350, of which 204 were cured, and 146 died; of these there were 193 cases of collapse, of which 66 were cured, and 127 died; 135 of these occurred in intemperate persons, of whom 109 died, and 26 were cured; 58 cases of collapse occurred in temperate persons, of whom 40 were cured, and 18 died. Of the whole number, 204 were intemperate, and 146 either temperate or their habits unknown. Seventeen nurses were attacked, of whom 2 died, and 15 were cured; 52 died of consecutive diseases; 3 puerperal women died; and 42 died within six hours from admission. Of the whole number, 50 were children, 37 blacks, 91 Americans, and 222 foreigners. Including hospital and private patients, in 1832 and 1834, we have treated or watched the treatment of more than 1000 cases of cholera; made numerous autopsical examinations; and for forty days and nights ate and slept among the sick, the dying, and the dead. We state these facts that the reader may judge whether we act presumptuously in questioning on some points the doctrines of our author in relation to the character, treatment, &c., of this disease.]

an inference. Did it originate about the period of the first irruption of the pestilence in the Delta of the Ganges, and propagate itself by extending its influence to the predisposed ever since, without any subsequent generation of the principle *de novo*, assuming more destructive features under circumstances which predispose to, or facilitate its transmission, as moist, unhealthy, or epidemic states of the air, &c.? Or does this disease arise in distant and unconnected places at nearly the same time, from some peculiarity of the air, or of its electrical states, or from some foreign material extricated from the earth, or floating in the atmosphere; and, having produced the fully-formed disease, an effluvium emanates from the affected body, capable of inducing the same train of morbid actions as those in which itself originated, the infectious principle being thus generated *de novo* on numerous occasions? That an infectious property is evinced by the disease cannot be doubted by any one who intimately examines its phenomena, particularly in connexion with their origin, or who has attended to his own sensations during and after respiring air contaminated by the effluvium from the sick, or after inhaling the miasms from the excretions or from the bodies of the dead; but whether this principle originated with the first eruption of the malady, or has been reproduced on numerous occasions subsequently, the disease which reproduces it proceeding from a very different cause, is a difficulty which will not readily be solved. It cannot be believed, however, that, where the symptoms of the disease are uniformly the same, the causes which occasion it should be so entirely opposite as are aerial influence and an animal poison generated in the bodies of the diseased; or, in other words, that very different and very opposite causes should be *uniformly* followed by the same effects on every occasion and combination of circumstances, the disease at the same time generating a cause which shall perpetuate it, of a very different nature from those in which itself originated. Indeed, we have no evidence of the reproduction of this principle in distant and unconnected places, from causes different from itself, inasmuch as there is no evidence of the disease having ever appeared under such circumstances, or, in other words, without communication with previously infected places; and hence we have no right to infer that a contingent combination of causes will reproduce this principle, until we have evidence to show that it does.

127. But in whatever way this question may be answered, if, indeed, it be ever satisfactorily answered, is not very material, as respects the nature of the malady. Whatever may be the exact origin of the efficient cause, there seems little doubt that it is inhaled into the lungs with the inspired air, where it acts as a poison, depressing the energy of the nerves supplying this organ, destroying the expansile actions it performs during respiration, and impeding those changes which the blood undergoes in the lungs. That the vital energy of the nerves distributed to the respiratory, the circulatory, and the secreting organs is either uncommonly depressed or entirely annihilated, is shown by the nature of the characteristic symptoms constituting the malady. The state of the respiratory function, particularly the laborious inspirations and rapid expirations, the coldness of the expired air, the involuntary and forcible retraction of the epigastrium and hypochondria, and the inexpressible oppression and anxiety referred to the chest, all indicate that the vital actions of the lungs are nearly suspended, and that the state of collapse and congestion, presented by them soon after death, had actually commenced during life. The impaired actions of the heart, the small, weak, and nearly abolished pulse, and the black colour of the blood, evince a suspension of those changes produced upon this fluid during respiration, and demonstrate not only a paralysis of the nervous energy of the lungs, but a marked diminution of the nervous power actuating the heart and arteries; the loss of vital or nervous power being necessarily followed by a suspension of the changes produced upon the blood in the lungs, by congestion of the abdominal viscera, by an exudation of the watery or serous part of the blood from the digestive mucous surface, and the discharge of it from the stomach and bowels, and by a total cessation of all circulating and secreting actions, owing to the loss of organic nervous power, and to the change in the state of the blood. The vital or ganglionic class of nerves (which forms a sphere of intimate union with each of its parts, supplies the lungs, the heart, and blood-vessels, and all the digestive, assimilating, and secreting viscera, and when powerfully impressed in any one part experiences a co-ordinate effect throughout the whole) is primarily and chiefly affected. Hence the alteration of all the natural secretions so rapidly supervening upon the morbid impression made by the efficient cause of the disease on the nerves of the lungs; hence the almost total abolition of circulation, assimilation, and secretion; hence the congestions of the large vessels and vital organs; and hence, also, the rapid extinction of voluntary power, as a necessary consequence of the suspension of those changes which, being produced in the blood, support the nervous energy and all the voluntary and vital actions. The retchings, evacuations, and spasms so generally observed, frequently follow upon any sudden diminution of vital power, and upon congestions of the nervous centres, and seem to answer wise purposes in the economy, inasmuch as they tend, by their influence on the circulation, to bring about a natural restoration of the vital actions, and to throw off the injurious load by which the springs of life are oppressed. They are efforts of nature to expel what is injurious, or to rally what is sinking. Where the powers of life are not too far reduced, these efforts will be energetic, and often successful, as very frequently remarked in respect of the less dangerous cases of this pestilence; but when the vital energies are far sunk, or where the serous portion of the blood is so far drained off by the digestive mucous surface as to render the blood unfit for circulation in the capillaries, these efforts will generally prove weak and inefficient, even when assisted by rationally devised means.

128. Whatever may be the exact nature of the exciting cause, and whatever may be its mode of operation on the frame—whether this cause primarily affects the organic nervous system, and the blood consecutively through the

agency of this system, as now maintained—or whether it passes at once into the circulation from the air-cells of the lungs, and affects the organic nervous system secondarily, there cannot, at least, be any doubt of the very remarkable changes produced on the blood in the course of the distemper. The analyses of the blood, of the bile, and of the evacuations by M. Le Canu, Dr. O'Shaughnessy, and others, show that, at an advanced period, the blood has lost one half of its serum, a considerable portion of its fibrin, and most of its carbonate of soda; while the rice-water-like evacuations consist chiefly of the serum of the blood, containing albumen and carbonate of soda, and other saline ingredients which are deficient in the blood. When the disease has gone on to the febrile or reactive stage, then urea accumulates in the blood, and even in the bile, owing to the paralyzed state of the kidneys. It is not improbable that a considerable change is going on, in a latent manner, in the blood before the serous portion of it is discharged from the digestive mucous surface; and that this change takes place chiefly in the lungs, and affects the vital relations subsisting between the serum, fibrin, and colored globules, as well as between the capillary vessels and blood circulating through them; and that the fully-developed period of the malady is the result, 1st, of this change, and, 2d, of the evacuation of the serum and other ingredients of the blood; capillary circulation in vital organs thereby becoming arrested. This state of the blood, in connexion with the impaired functions of the lungs, of the kidneys, and of the liver, is evidently the source of the consecutive fever.

129. It has been now shown, both by reference to the appearances displayed by investigations after death, and by connecting these with the phenomena presented by the disease during life, that the requisite changes are not produced upon the blood by respiration; and that the emunctories, which remove from the circulating mass those materials which would prove highly injurious and irritating to the frame if they were allowed to remain in it, have their functions entirely suspended; while, at the same time, the serous portion of the blood escapes from the digestive canal in so large a quantity as to change the physical condition of the blood in the vessels, and thereby to interrupt the circulating functions in vital organs. Can it, therefore, be a matter of surprise that, when reaction of the vital powers of the system is brought about, very great disturbance, not only of the circulating system, owing to the altered state of the blood, but also of the encephalon, and of the different emunctories, is immediately manifested? Indeed, these consecutive states of disease, which have been well illustrated by observation, are entirely in accordance with *à priori* inferences in pathology.

[Whether we suppose the cause of cholera to consist in a contagious miasm, emanating from the bodies of the sick, or some peculiar morbid principle, or change in the elements of the atmosphere, the manner in which it operates upon the human organism is purely a matter of hypothesis. We fully agree with Mr. Copland that the disease is an infectious one, but then it is only so under peculiar and rare circumstances, and when some conjunction of causes, or elements which we do not as yet understand, is brought about. We have known the disease apparently originate *de novo* in many places where it could not be traced from abroad, and hence we conclude that, like typhus fever, its prevalence is owing to two distinct causes, although its phenomena are identical. It is not certain, however, by any means, that the aerial poison which causes cholera produces its effect by a direct impression on the respiratory nerves; it is far more likely to be attracted into the circulation, and produce its effects upon the solids of the system, and the large secretory and excretory organs, through the medium of the blood. We incline to the latter hypothesis. Prof. Paine, of New York, in his very able work, entitled "Letters on Cholera Asphyxia" (1842), expresses the opinion that the proximate cause of cholera consists in a simultaneous modification of all the organic powers and functions, produced by some unknown morbific poison, acting either directly on the properties, or transmitted indirectly through the nervous system. He supposes the primary impression to be made on the organs of sensation and sympathy, and, perhaps, through the organic properties of that system. This change, so produced, he considers not merely *a depression* of the vital powers, but that there is probably an *alteration* of their specific character, as seems to be denoted by the remarkable derangement of some of the functions.

Although there is abundant evidence that the organic system of nerves is profoundly affected in all its ramifications, there is equal reason to believe that the cerebro-spinal system is but slightly influenced by the choleric poison. Spasms occasionally occur in places during the prevalence of cholera, and this, too, without any other symptom denoting the epidemic influence, but there are evidently fewer lesions of that system through the whole progress of the disease than of the organic and sympathetic. The brain and the nerves issuing from it undoubtedly serve to transmit the impression which they receive to other parts of the body, but if we look at the mind we shall find it "sitting unimpaired and serene amid the ruins of organic life." "Respiration is only performed by the voluntary muscles, pulsation has long ceased in the extremities, the heart has become inaudible to the stethescope, yet the integrity of the mind remains undisturbed, and the indifference with which it contemplates the wreck over which it presides proves that at least its peculiar and last abode in the body is still its own undivided possession."]

130. I conclude this part of the inquiry by stating the inferences which may be drawn from an extensive view of what is known of this pestilence, as it has appeared in Asia and in Europe, and from intimate observation of its phenomena, as they lead to various considerations calculated to arrest its progress and to remedy it, when an attack has not proceeded too far in the destructive processes in which it has been shown to terminate.

131. *A.* The pestilential cholera seems to have been propagated by an animal miasm or effluvium of a peculiar kind, emanating from the bodies of the affected; and this effluvium, being inhaled with the air into the lungs, par-

alyzes these organs, and acts as a poison on the class of nerves which supplies the respiratory, the assimilating, the circulating and secreting viscera, vitiating also the whole mass of blood, and thereby occasioning a specific disease, which in its turn gives rise to an effluvium, similar to that in which itself originated; which, also, in like manner perpetuates its kind, under the favourable circumstances of predisposition, aerial vicissitudes, &c., and thus a specific form of disease is propagated far and wide, as long as predisposing, concurrent, and determining causes favour its propagation.

132. *B.* The morbid impression of this effluvium or poison upon the nerves of organic life, and probably the effect of its introduction, also, into the current of the circulation, are of a sedative kind, rapidly destroying the vital energy of the former, and vitiating the latter, and thereby giving rise to the characteristic phenomena of the malady.

133. *C.* The impression of this effluvium on the organic class of nerves, and the vitiated state of the blood, may be viewed as the proximate cause, not only of the disturbance evinced by the respiratory, the secreting, the assimilating, and the circulating functions, but also of the morbid actions of the stomach and bowels, and the copious serous discharges from these organs, as well as of the muscular spasms, the sinking of all the vital and animal powers, of the shrunk and collapsed state of the surface of the body, of the black, thick state of the blood, and of the rapid depression of the animal temperature.

134. *D.* The states of the perspiration and skin, and the discharge of the serous portion of the blood by the stomach and bowels, imparting the peculiar appearance of the evacuations, proceed from the alteration primarily produced in the vitality of the frame and in the condition of the blood; and it is chiefly through the medium of the cutaneous surface, of the liver, of the kidneys, and of the mucous membranes, assisted, perhaps, also by the other secreting viscera, that the morbid change of the blood is remedied, and impurities removed from it.

135. *E.* The advanced stages, or the consecutive or febrile symptoms of the disease, whether those chiefly depending upon the state of the nervous functions, or of the circulation within the brain, or proceeding from the condition of the abdominal viscera, arise partly from the shock received by, and the depression of, the vital energy of the frame in the early stage, partly from the congested condition of the large veins and important viscera, and partly, if not chiefly, from the alterations which had taken place in the blood during the early stages of the malady.

136. *F.* The effluvium or seminium, which propagates the distemper, is generated in the progress of the changes produced in the blood, and is emanated or discharged from the mucous surfaces of the lungs and digestive canal, and from the cutaneous surface, along with their respective exhalations and excretions; and this seminium, by contaminating the surrounding air, or woollen cloths and animal products, capable of attracting and retaining for a time animal effluvia, as shown above (§ 92), affects those of the healthy who are predisposed, either constitutionally, or by antecedent, concomitant, or determining influences, or on whom this efficient agent acts in an intense or concentrated form, or is aided by accessory or concurrent causes.

137. VI. Treatment of Pestilential Cholera.—The means of cure which should be employed, in order to secure even a moderate share of success, ought to be appropriately prescribed, and strictly directed to the various pathological states and stages which the disease presents in different habits and constitutions, and in its various grades of severity. It is, in some measure, owing to a neglect of this strict appropriation of the numerous plans and means of treatment recommended, and to the empirical manner in which they have been administered, that opinions have been so different as to the utility of the greatest number of them, even at an early period of the malady; at a far-advanced stage, very few remedies, indeed, have hitherto been employed with any remarkable benefit. In order that the means chiefly depended upon by the numerous writers on this malady may be more strictly referred to the circumstances under which they seem to be indicated, and often to have really proved beneficial when early employed, I shall *first* succinctly state the chief forms and stages of the disease, with reference to various grades of intensity, and existing pathological conditions; I shall *next* briefly notice the methods which have been employed by various authors; and, *lastly*, detail, with strict reference to these different states and stages, the treatment I venture to recommend, according to my own experience and observation.

138. i. *Grades and Stages of the Malady, with reference chiefly to Curative Measures.*—The mode of attack, as well as the severity of the disease, vary materially, according to the intensity of the exciting cause, the nature of the concurrent causes, the state of predisposition, and the strength of the patient's constitution.

139. *A.* The invasion of the disease generally presents itself in *three* different grades, owing to the above causes.—*a.* The *first* and least dangerous grade or state of invasion is the most gradual, and is usually that of a common diarrhœa, varying in duration from a few hours to one or two or even more days, accompanied with oppression in the chest, and anxiety at the præcordia, and collapse of the countenance and surface of the body. If these symptoms be neglected, they soon pass into those characteristic of this malady, viz., marked and sudden loss of pulse; oppressed and difficult respiration; muscular spasms or tremours; shrunk, wet, and leaden appearance of the surface and extremities; sunk eyes, and watery vomiting and purging, with great distress. This is generally the *least severe* form of the malady, and is commonly met with in the younger and more robust class of subjects. For the sake of distinction, I shall term it the slighest grade, or that characterized by premonitory diarrhœa, &c.

140. *b.* The *second* state of invasion is the most frequent, and is generally ushered in by cerebral symptoms, such as giddiness, noise in the ears, by a remarkable oppression of the chest, weight at the epigastrium, and a great depression of the pulse and of all the vital en-

ergies, rapidly followed by spasms, commencing at the farther parts of the extremities, and accompanied with watery purging and vomiting, and all the symptoms described above (§ 28). This is the common form or degree of severity of the malady.

141. *c.* The *third* state or form of invasion is the most sudden and fatal. The patient is suddenly seized, as if struck by lightning, or by a severe blow on the epigastric centre. His vital powers are immediately laid prostrate; inordinate discharges of serous fluid take place from the bowels and stomach, with cramps and spasms of the voluntary muscles; and he is usually found without pulse at the wrist; with most laborious respiration; shrunk, purplish, raw, wet, and cold condition of the surface of the body; and collapsed, terrified state of the countenance. This *severest grade* of the malady generally seizes on the old, the debilitated, or most highly-predisposed persons, and often terminates life in a few hours, with a most rapid and continued sinking of all the functions.

142. This *last* form or state of the disease is generally beyond the reach of medicine; it is chiefly in the two former that medical means avail. These *three* modes of invasion and grades of the distemper should be distinctly borne in mind, as requiring very distinct and decisive modes of cure. Besides attending strictly to these STATES of the disease, as indicated chiefly by the modes of its INVASION, the practitioner is required to notice attentively,

143. *B.* THE PERIODS OR STAGES which mark its course.—*a.* The *first* or premonitory stage, or the incipient state of diarrhœa, during which, in addition to much vital depression and imperfect discharge of the vital and natural functions, the serous portion of the blood is being effused from the digestive mucous surface, constituting, as well as the more sudden and rapid effusion of serum, a serous hæmorrhage from the digestive canal.

144. *b.* The *second*, or the cold and blue stage, is that of *extreme depression*, the symptoms indicating the utmost sedative effect of the exciting cause of the disease on the vital powers, with a morbid state of the circulation. The extreme degree of this period constitutes the *third*, or severest form of the malady (§ 29, 141), it being so marked as to entirely overwhelm life in a short time, without any other period or stage supervening.

145. *c.* The *third period* is that of morbid reaction, and is evinced by returning warmth and pulsation, and diminution of the leaden state of the surface.* It passes either into convalescence, or into exhaustion and disorganization. This period, as stated above (§ 29), may not appear in the severest forms of the disease. But when it does supervene, it presents the symptoms already described, when treating of the consecutive phenomena of the malady (§ 33). In many instances, life is not destroyed by the morbid state forming the first period of the disease; nor is it so completely overwhelmed as to prevent all reaction; but the reaction which is produced, being accompanied with the morbid state of the blood, the principal part of its serum being lost, and with a considerable share of the congestion of vital organs characterizing the preceding period, is necessarily imperfect, and readily passes into an adynamic state of sub-inflammatory action, affecting chiefly important and vital organs, and often assuming the form of malignant fevers complicated with visceral disease.

146. *d.* The *last stage*, or that of exhaustion and disorganization, is always a consequence of attempts at reaction, which are, however, often imperfect, and extremely morbid in their nature (§ 33, 34), owing to the marked impression made by the exciting cause on the vital energies, and chiefly to the very evident deterioration of the blood. This stage takes place more or less rapidly, and, when once present, the fatal tendency is great, and is very rarely arrested by treatment. In a very large proportion of cases, the febrile symptoms arising from reaction are accompanied with more or less of congestion, or of a sub-inflammatory state of some vital organ, frequently of several, as of the encephalon, alimentary canal, liver, lungs, &c., and when the consequent collapse terminates in death, these organs manifest the nature and extent of their disturbance.

147. It should be kept in recollection that the *third stage*, or that of reaction, as well as its consequences, namely, exhaustion and disorganization, can only occur in the *first* and *second* grades of the disease, or in those cases which have not proved fatal from the *second* or cold stage. The *third* stage is identical with, and presents the phenomena described as forming the consecutive states of the disease (§ 33). Owing to the important features it often assumes, it requires a more particular notice: 1st. A congestive and sub-inflammatory state of the encephalon and spinal marrow, assuming the characters of typhoid, or malignant nervous fever, and proving the most frequent and fatal form of the second period; 2d. A bilious or bilio-nervous form of fever; 3d. A sub-inflammatory state of the stomach or of the bowels, and frequently of both conjoined; and, 4th. An irritative or sub-inflammatory state, with congestion of the lungs, accompanied with oppression and pain in the chest, cough, and viscid expectoration.

148. The *exhaustion* into which these stages gradually pass, and which forms the fourth or last stage of the malady, is generally attended by symptoms indicating more or less congestion, particularly of those organs which manifested the chief disturbance during the period of reaction. Its accession is often rapid. It requires to be accurately recognised and promptly met, in order to ensure any share of success in combating it; and even then success very rarely results.

149. When death occurs in the first stage, as it often does in the highest grade of the disease, the chief changes are observed in the blood, the lungs, and vascular system (§ 43, 45), the vital functions being so rapidly abolished, from the impression of the exciting cause of the malady, that the morbid influence can be evinced only on this system, and there chiefly as respects the state of the circulating fluid, a sufficient length of time to produce disorganization to any very remarkable extent not having elapsed between the invasion and termination of the disease. But when death takes

[* But in objection to the classification of the author the very first invasion is frequently that of marked inflammatory symptoms of general fever and violent, painful spasms.]

place after the period of reaction, organic changes are observed in various important viscera (§ 46), which, however, with the disturbance of vital functions, and in which they chiefly originate, only partly account for the fatal result. The thick and venous states of the blood, owing to the remarkable loss of serum and to the arrest of the changes produced by respiration on the blood, manifestly interrupt the capillary circulation in vital organs, and occasion the phenomena of the advanced stages of the distemper, and ultimately death.

150. It will be necessary to acquire precise ideas of the foregoing *forms* and *stages* of the malady, in order to devise appropriate means for counteracting their fatal tendency.

Synopsis of the Forms and Stages of Pestilential Cholera, depending upon the severity of attack.

First grade.—With marked premonitory symptoms, particularly diarrhœa, &c. (§ 26, 139).

Second grade.—Commencing with giddiness, faintness, &c., rapidly followed by the characteristic features of the disease (§ 28, 140).

Third grade.—The seizure sudden and intense (§ 29, 141).

- *First stage*, or preliminary diarrhœa, which may be readily arrested without farther disturbance beyond indigestion, &c.
- *Second stage*, or that of extreme depression or failure of the circulation (§ 28), often quickly passing into dissolution, but sometimes followed by the
- *Third stage*, or reaction, or febrile affection, with suppression of the urinary and biliary secretion (§ 33).
  - *A.*—Reaction with typhoid, or maligno-nervous febrile affection (§ 34).
  - *B.*—With gastro-enteric affection, &c. (§ 35).
  - *C.*—With bilious affection, &c. (§ 35).
  - *D.*—With pulmonary affection, &c. (§ 35).
  - *E.*—With two or more of these conjoined.
- *Fourth stage*, or that of vital exhaustion and disorganization, often terminating in death.

Most frequently consisting of the stage of depression only, rapidly terminating in death, and more rarely followed by reaction and the stages and states above enumerated.*

151. ii. *Notice of various Modes of Treatment employed in different Countries.*—M. Benoit states that he found the combination of camphor, laudanum, and sulphuric ether, with the external use of sinapisms to the epigastrium and extremities—means employed by numerous practitioners—successful in the visitation of the pestilence at Manilla, in 1820. Mr. Craw (*Bombay Reports*) speaks very favourably of large doses of ammonia and musk. Dr. Peitsch (*Fodcré*, p. 261) states that his practice in Java showed the uncommon efficacy of two parts of spirits of mint, one part of spirit of lavender, and one of laudanum, taken in doses of a spoonful, until the vomiting ceased. Mr. Milward (*Bomb. Rep*) informs us that he found magnesia, in doses of four scruples, remain in the stomach and procure natural evacuations, other means having failed. Dr. Mahir, of the Polish army, employed large doses of opium and prussic acid, with lavements of asafœtida. Several physicians in Russia, Poland, and Germany had recourse to moxas, or the actual cautery applied either along the spine or on the scrobiculus cordis, but with as much benefit as may rationally be expected from such means. Many of the physicians at Warsaw ascribed good effects to the magistery of bismuth, while others stated it to be more injurious than beneficial.

152. The treatment which was recommended by Mr. Corbyn, and very generally adopted in India, consisted of from fifteen to twenty grains of calomel, washed down with sixty drops of laudanum, and twenty drops of the oil of peppermint, in two ounces of water. He prescribed full blood-letting in Europeans, and repeated the above medicines every three hours until relief was obtained. The oils of peppermint and cajeput were very generally used in India, and they seem to have been frequently serviceable, but as adjuvants merely.

153. Mr. Annesley confided in blood-letting employed early in the disease, and in large doses of calomel, with moderate quantities of opium, followed by warm, stimulating purgatives. His object in prescribing these medicines was to remove the tenacious muco-albuminous matter lining the internal surface of the intestines, which he viewed as obstructing the canal. But he ascribed undue importance to a change contingent upon the advanced stage of the malady, the existence or removal of which could but little affect its course.

154. Mr. Searle advised the patient to be placed between very warm blankets in an airy apartment; and, as he considers a deranged state of the stomach is generally connected with the origin of the attack, the free evacuation of this organ to be among the earliest intentions to be fulfilled. For this purpose he recommended, whether the patient has vomited or not, that he should drink freely of warm water in which common salt has been dissolved—about a table-spoonful of the salt to half a pint of hot water; that bleeding should be practiced, and, after the stomach is evacuated, that a full dose—about twelve grains—of calomel be exhibited, and washed down with hot brandy and water, and that this be repeated every hour or two, until an improvement is observed, when it may be given in smaller doses, and either in conjunction, or alternately, with some mild aperient. For the sub-inflammatory states of the encephalon, or abdominal viscera, frequently supervening during reaction, or the third stage of the malady, he recommends the employment of moderate, general, and local depletion, with injections and counter-irritation, by means of sinapisms. He found the cramps relieved by compression.

155. Mr. Goss, of the East India Company's

* [Professor Jackson, of Philadelphia, makes *five* grades or periods of the disease, viz.: 1st. Of incipient irritative, or the premonitory stage; 2d. Of confirmed irritation, or forming stage; 3d. Of incipient concentration, commencing collapse, or algid state; 4th. Of complete concentration, confirmed collapse, or perfect algid state; 5th. Of reaction, or febrile state.—*Am. Jour. Med. Sci.* (vol. ii., p. 306).]

service, states, that hearing the patients complaining of the excoriating nature of the fluids evacuated, he suspected this property to depend upon the presence of some acid, and that he, therefore, exhibited about a drachm of the carbonate of soda with fifteen grains of the carbonate of ammonia; the patients, who were very few, and their cases slight, all recovering under this mode of treatment. He likewise had recourse to full blood-letting, occasional doses of calomel and jalap, to frictions and counter-irritants applied to the abdomen and lower extremities. He states that emetics had failed in some instances in which he had employed them, but had succeeded in others. He appears to have employed the ipecacuanha powder merely, without combining it with diffusible stimuli, and therefore his failure in the most severe cases was to be expected.

156. Dr. Raimann, of St. Petersburgh, states that blood-letting, with calomel and opium, and external heat and irritation, were among the most successful means employed against the disease in Russia. Warm baths were of equivocal service, unless at the very commencement of the seizure, or in the slightest cases. They generally exhausted the patient instead of restoring the circulation to the surface in the more severe cases.

157. M. Vos, who practiced in Batavia, found blood-letting of service among Europeans only: it was injurious in the natives. The remedies from which he derived the greatest advantage were calomel with opium, followed some time afterward by warm stomachic purgatives and injections. M. Margeot, who observed the disease in the Isle of France, prescribed, every two hours, two drachms of the sulphate of soda in a glass of honey-water, until bilious evacuations appeared. He gave diluents liberally, and administered emollient injections frequently, with the view of promoting the action of this salt. M. Robert, who adopted this practice, added to it the occasional exhibition of a draught with ammonia; and M. Galdemar employed a draught with olive oil, sulphuric ether, and camphor.

158. Mr. Boyle, who treated the disease in India soon after its first appearance, finding, in the post-mortem examination which he first made, that the gall-ducts were obstructed by a thick viscid bile rather than by spasm, was led to exhibit emetics and procure full vomiting, in order to remove this obstruction of the passage of bile to the duodenum; and the advantages which he obtained from the practice induced him to recommend it in preference to other means which he considered subordinate to it, and requiring to be varied according to the circumstances of individual cases, the use of emetics being always requisite. To this gentleman the credit is due of having been the first to recommend emetics for the disease.

159. Several of the American practitioners, who had visited India and China during the prevalence of the pestilence, prescribed powdered carbon and burned cork in milk, and conceived that benefit resulted from the practice. This substance, however, as well as many others to which a certain degree of credit was attached, only seemed of advantage, it being apparently successful in the slighter cases of the disease, in which the morbid actions induced in the frame operated their own cure, through the aid of the powers of the constitution. This practice, however, was strongly recommended by Dr. Jackson, an authority of the greatest weight in dysentery and chronic diarrhœas, in which affections it appears to have been extremely serviceable.

160. When the disease appeared in Persia, the native practitioners had recourse to cold affusions, and cold acidulous, or iced fluids, of which the patients were allowed to drink at will. At Bussorah, M. Morando prescribed cold applications over the organs chiefly affected, at the commencement of the attack, and blood-letting, both general and local. M. Meunier, at Bagdad, treated the disease by means of venesection, leeches applied to the pit of the stomach, mucilaginous and opiated draughts and injections, and hot fomentations. A similar practice to this seems to have been very generally adopted by medical men in Syria, Mesopotamia, and Aleppo. Of the effects, good or bad, of the cold affusion as adopted in Persia, I can find no precise information. But, judging from the great benefit I have seen derived from the cold affusion on the head, in cases of poisoning by opium, even when life, apparently, is nearly extinct, this practice seems to me not so irrational as many may suppose. It is, at least, one of the most energetic means with which I am acquainted of removing congestion of the vessels within the head.

161. When the disease appeared at Astrachan, in 1823, the medical commission prescribed the following practice: A large blood-letting; a dose of calomel, with sugar or gum Arabic, and followed by from forty to sixty drops of laudanum; twenty drops of the oil of peppermint, given in two ounces of the aqua melissæ; frictions of the epigastrium, with an ammoniacal liniment; scarification and cupping over the abdomen; frictions of the limbs and surface generally, with camphorated spirit; mucilaginous injections, with about thirty drops of the tincture of opium, and calomel in doses of from ten to twenty grains. This practice, which was altogether based on that very generally employed in India, was likewise adopted when the disease invaded Russia in 1830; but on this occasion blood-letting was found less beneficial than formerly, and warm sudorifics, and the external application of heat, were more depended upon.

162. Dr. Keir, who had great experience of the disease at Moscow, derived advantage from blood-letting in the young, plethoric, and well-fed, and in the common or intermediate grades of the malady, particularly when employed early, or before the pulse left the wrist. In the most intense grade, or when resorted to late, or when the pulse had disappeared from the arm, it often seemed prejudicial. Full doses of calomel with opium, followed by stimulants, purgatives, and injections, and accompanied by the external and other means usually employed by the Indian practitioners, formed the principal part of the treatment adopted by him.

163. When the pestilence appeared in Warsaw, the medical authorities there had recourse to very nearly the same treatment as stated in the preceding paragraph (§ 162). Subsequently, many adopted, and several afterward relinquished, the plan of Dr. Leo, which was to give

three or four grains of the sub-nitrate of bismuth every two hours. According to M. Boisseau, the hydrocyanic acid, the hydrocyanate of zinc, oxygenated water, and oxygen gas were all tried in this city without benefit; and I may add, that laurel-water, phosphorus, both internally and externally, moxas, and the actual cautery to the spine and epigastrium, were also made trial of without any remarkable advantage. M. Briere de Boismont recommended (when vomiting continued urgent) the cuticle to be removed by means of liquid ammonia, and the denuded surface to be sprinkled with one or two grains of the acetate of morphine.

164. Mr. Finlayson derived advantage in one case in Ceylon from passing a galvanic current through the lungs. Galvanism certainly deserved a fair trial in this disease; but the instances in which it was resorted to in this country did not furnish evidence of its success.

165. Dr. Barry, having very frequently observed congestion, inflammation, and softening of the spinal marrow, in a greater or less degree, in his examination of fatal cases of the pestilence, was led to recommend the application of the actual cautery to the back, opposite the lower dorsal and upper lumbar vertebræ: it had been employed on the Continent with some success. He also advised full vomiting, and for this purpose preferred a strong solution of common salt and water, given in doses of six ounces. Warm, dry applications to the skin, and continued friction, he considered very beneficial, while vapour and hot-water baths he believed to be worse than useless. Bleeding, as well as large doses of either opium or stimulating liquors, he believed to be dangerous in the utmost state of depression, when the powers of life are reduced to the lowest ebb, and consequently easily annihilated; but previous to this state, or when reaction is supervening, he considered blood-letting beneficial to the patient.

166. The following account of the experience of several physicians at Warsaw, abridged from that given by M. de Boismont, is important, as showing the results of different kinds of practice:

Dr. Janikowski treated sixty-six cases. He bled the robust and those with evident congestion, and gave every three hours two grains of calomel, with one of opium, with warm stimulating diluents, sinapisms on the epigastrium, and frictions of the limbs with irritating liniments. In some cases he gave the nux vomica in doses of half a grain, every fourth hour, in an emollient decoction, and, he conceived, with some advantage. He lost twenty, chiefly old persons, of the number treated. Dr. Koehler had sometimes recourse to blood-letting, but depended more upon the preparations of ammonia. He also prescribed calomel with opium, and in some cases large doses of the sub-carbonate of potash. The farther results of his experience are not given. M. le Brun treated about sixty cases, of which he lost nearly one half. The disease was, however, far advanced before they came under treatment. He confided chiefly in blood-letting, warm diluents with opium, and camphor combined with calomel. Of twenty cases treated in private practice five died. The remaining forty were hospital cases. Dr. Enoch treated forty-three cases, of which five were hospital patients. He lost only seven cases, chiefly aged persons. The most of his patients were blooded, and treated with calomel and opium at first, and afterward with calomel and rhubarb. He directed sinapisms to the epigastrium and extremities. Dr. Jasinski treated thirty cases, of which ten died. In his earliest cases he employed blood-letting when he thought it indicated, or leeches to the painful part of the epigastrium, with small doses of calomel and opium, and the infusion of valerian. In the cases which occurred subsequently, and which were generally more intense, he prescribed leeches to the abdomen, the magistery of bismuth internally, and sinapisms and frictions to the extremities. Dr. Kaczkowski, physician-in-chief to the Polish armies, had recourse in the most severe cases to large blood-lettings, to calomel in doses of three or four grains, with half a grain of opium every two hours, with the external use of sinapisms, stimulating cataplasms, moxas, &c. He also frequently prescribed, every two hours, small quantities of Dover's powder with mint ptisans, and large doses of magnesia; and states that he derived advantage from the nux vomica, given with the mucilage of gum Arabic and sugar or sirup. He lost one sixth of his patients, among whom, however, he seems to have included several cases which evidently either did not belong to this disease, or consisted of the slight form, or of the incipient stage.

167. Most of the individual means and plans of cure noticed above were had recourse to when the disease appeared in this country, but generally with that want of success, especially in the severer and more advanced cases, which led to the relinquishment of them, and to the trial of other medicines and different combinations. *Blood-letting*, which had been advised both by Indian and European physicans, was resorted to, but with very equivocal benefit; for it was only in slight cases, or in an early stage of the disease, and in young, plethoric, and robust persons, that it seemed to be of service; and in these either equal advantage would have been derived from other means, or recovery would have been brought about by the powers of the constitution. The same remarks apply also to the use of *opium*. This remedy could only be viewed as an adjuvant of other means, and it was often a valuable one, in aiding to check the diarrhœa, in the slighter cases and earlier stages. But when the attack was violent, and when the collapse was great, it either failed of producing any effect, or occasioned an injurious one.

168. The failure of the more usual means led to the adoption of warm *emetics* by several physicians, especially of those consisting of large doses of mustard, or of the substances usually employed with this intention, conjoined with powerful stimulants. But in the more violent seizures, or at an advanced period of the disease, they did not appear to me to be productive of any benefit.

169. Indian practitioners, owing to their predilection to the use of *calomel*, especially at the period of the outbreak of the pestilence in India, and to the absence of bile in the evacuations, had recourse to this medicine, generally

in large or very frequent doses, and in conjunction with opium. They imputed too much importance to the absence of bile, looked upon this as the chief source of mischief, instead of viewing it as a part only of the general circle of consecutive disturbance, and aimed merely at removing a symptom without directing attention to more general and important morbid conditions. In certain states, however, of the malady, hereafter to be noticed, and in certain combinations, it was often of more or less service.

170. Dr. GRAVES, impressed with the little efficacy of the means previously recommended, and with justice believing that it was of the first importance to arrest the discharge of the serum of the blood from the digestive mucous surface, recommended full doses of the *acetate of lead* to be given with opium, varying the quantity and frequency of the dose with the severity of the case. Previously to the publication of this method, I had been employing the *sulphate of zinc*, with opium and extract of logwood, and *sulphate of alumina*, in similar combinations, with this intention; but my experience hardly enables me to decide as to the comparative merits of either, for each was efficacious in the less violent cases, and inefficient when the collapse was extreme.

171. The saline treatment advised by Dr. STEVENS for malignant fevers, with a confidence which subsequent experience has not justified, was sufficiently tried in this pestilence, and in several cases by myself. The ascertained deficiency of the saline ingredients of the blood, in the fully-developed distemper, he proposed to restore by giving every half hour or hour half a drachm of sesquicarbonate of soda, a scruple of muriate of soda, and seven grains of chlorate of potash, in half a tumbler of water. The trials which I made of this medicine did not furnish greater success than that derived from others. The state of vital action; the complete arrest put to the function of absorption from the alimentary canal, and the general relaxation of the capillaries and of the digestive mucous surface, with the consequent serous exudation, did not admit of the passage of saline solutions or fluids from this canal into the circulation.

172. Knowing the deficiency not only of the saline ingredients of the blood, but also of the serum, and believing that the deficiency could not, in the existing state of vital action, be supplied by the alimentary canal, Dr. O'SHAUGHNESSY was thereby induced to propose the injection of saline solutions into the vascular system. The solution most generally used consisted of half an ounce of muriate of soda, and four scruples of sesquicarbonate of soda in ten pints of water, at a temperature varying from 104° to 112° or 118°; and the whole was injected slowly, and generally during somewhat more than half an hour. Several cases which I attended were thus treated, two of them of medical men; but none recovered ultimately. Dr. MACKINTOSH, of Edinburgh, treated many in this way; and, in the institution to which he was attached, of 156 patients in whom this plan was employed, twenty-five recovered. Most probably these were all hopeless cases; but, as far as I could learn, this plan was not much confided in generally in the metropolis, and was employed only as a last resource. When recovery did follow after a recourse to it in these circumstances, the event could not fail of attracting particular notice; yet, as recovery did also occur, although in rare instances, even in the worst cases, apparently from the powers of the constitution rather than from the means employed, the degree of success evinced by this method was more or less questioned. Phlebitis, which always proved fatal, supervened in some cases.

173. The effect of the injection of the above solution into the mass of blood was always remarkable on the disease. All the symptoms subsided, or entirely disappeared, except the excessive evacuations. These, however, returned, or became still more profuse; until a very short time after the injection, the whole of the fluid had passed off by the bowels, and all the phenomena reappeared, generally with increased violence and extreme vital depression, often rapidly passing into dissolution. This circumstance shows that the disease did not merely consist in the loss of the serum of the blood, but in an alteration of the blood still more materially affecting its vital constitution, and most probably originating, as I contended in the work published in 1832 on this distemper, in the altered vital condition of the ganglial or organic nervous system, and implicating the vascular system and circulating fluids consecutively.*

174. iii. *Treatment chiefly confided in by the Author after observing the Effects of various Means and Methods.*—When the disease is prevailing in any locality, disorder of the stomach and bowels should receive early attention, and be treated with great decision. Strict attention to my own sensations during and after the impression of the morbid exhalations from the evacuations, and from the bodies of the sick or dead, and the experience of many of my friends when their attention was directed to the matter, convinced me that the morbid impression first made upon the organic nervous system was characterized by depression; and that the consequence of such depression, and of such other change in the state of this system as may have taken place in addition, were soon afterward manifested in the vascular system, and in the several digestive, assimilating, and excreting functions, if the primary morbid impression was not removed by powerful stimulants and tonics. It is necessary, therefore, not only to develop vital resistance and action by these means as soon as the earliest indications of depression appear, but also to restrain frequent or increased evacuations from the bowels, as being the most prompt modes of preventing these changes from taking place in the blood, which soon induce the most serious and fatal results.

175. When the disease is more fully developed, it is necessary to combine our means judiciously and energetically, to bring several agents into action at the same time, to direct them to different organs and opposite parts of the frame, and thereby to fulfil, directly and contemporaneously, several intentions and in-

[* We tried the injection of saline solutions into the vascular system, after the plan recommended by O'SHAUGHNESSY, in 13 cases, with the effect above described; the patients were all in a state of hopeless collapse. Of these one only recovered.]

dications. In all circumstances it is requisite, even to a moderate share of success in the treatment of this pestilence, to prescribe the means of cure appropriately to existing morbid conditions—to the pathological states and stages of the malady—and not empirically, or without reference to the known operation of these agents on the diseased actions which we employ them to remove.

176. *A. Treatment in the mildest Form and earlier Periods of the Distemper.*—(*a*) It has been stated above (§ 27) that the attack in its mildest form, and in young, robust, or previously healthy persons, was very frequently ushered in by diarrhœa and general depression of the vital powers, with or without nausea, vomiting, or spasms; and that, if these symptoms were removed by energetic means, the disease generally proceeded no farther. In most cases, however, in connection with diarrhœa and depression of vital power, there was also more or less congestion of vital organs, especially of the lungs, liver, and large venous trunks; and hence it became necessary to remove this congestion, while we endeavoured to restrain inordinate discharges from the alimentary canal, and to allay spasm when present; the *intentions of cure* being thus—1st. To arrest purging and vomiting; 2d. To remove congestion and oppression of the viscera, and to determine the circulation to the surface and extremities; and, 3d. To restore the secretions and excretions to a healthy state.

177. The first of these indications should be fulfilled by exhibiting warm astringents and stimulants, conjoined with the remedies usually prescribed for Diarrhœa (*see that article*, § 26, 30); of these means I have found the sulphate of zinc, with capsicum and opium, the most efficacious, especially when exhibited in frequent doses. The opium should be given in small or moderate doses, so as to support, but not to depress, the powers of life, and always with aromatics and astringents—with capsicum, aromatic confection, confection of black pepper, extract of logwood, sulphate of alumina, acetate of lead, &c. The sulphate of zinc, when conjoined with cayenne or black pepper, or with other aromatics and opium, will not readily excite vomiting. But if an *emetic* effect be produced by the quantity thus prescribed, the circumstance will not prove injurious; but will tend to remove internal congestions, and to fulfil the second and third indications, without increasing the intestinal discharges.

178. In cases where vascular plethora exists, a moderate blood-letting may be instituted, so as to bring the mass of the circulating fluid more nearly to the state of the moving powers; but it should be prescribed with caution, and only for young, robust, or plethoric persons, and either at an early stage or in the slighter form of the malady. If these means do not speedily arrest diarrhœa and other symptoms, they should be aided by the application of dry warmth and frictions to the surface of the body. Dry warmth may be applied by placing the patient instantly in bed, and elevating the bedclothes around him by two or three common hoops, or pieces of whalebone, and then introducing one end of a wide tube, at the other extremity of which the flame of a spirit-lamp or candle should be made to pass; or bags of hot salt, or of hot bran or oats, may be placed around him.

179 The removal of congestion and the equalization of the circulation will be promoted by employing assiduously, at the same time that external heat is being applied, frictions of the abdomen, chest, and thighs, with a liniment composed of two ounces each of liquid ammonia, of olive-oil, and spirits of camphor, with three ounces of spirits of turpentine, and from three to six of hard soap and cayenne pepper, to which about two or three drachms of cajeput or lemon oil may be added. Or hot flannel, soaked in a mixture of these, may be applied over the abdomen and over the insides of the thighs, and renewed until warmth is restored. If the attack be attended by spasms of the muscles of the abdomen or thighs, this mixture may be used either as a liniment or as an embrocation, as now advised. The external applications should be assisted by the internal administration of ether, camphor, ammonia, calomel, opium, aromatic spirits, and essential oils, either singly, or in such forms and combinations as the circumstances of particular cases may point out.

180. If the irritability of the stomach continue, and if the attack be severe, flannels wrung out of hot water, and immediately soaked with the embrocation just now described (§ 179), or with warm spirits of turpentine, ought to be instantly applied, as warm as possible, over the stomach and abdomen, and retained there, or renewed, until a decided effect is produced. This is the most powerful means I am acquainted with, and the most successful in procuring reaction and restoring the heat of the body.

181. The foregoing means frequently accomplish the last of the intentions of cure enumerated above (§ 176), by fulfilling those which preceded it. But we should never consider the patient to be placed in a fair way of recovery by bringing about reaction merely, unless the suppressed secretions be also restored. It should be kept in recollection that an early effect of the exciting cause of the disease is to vitiate the whole mass of blood, and that this morbid state can be removed only by supplying the loss of the serous parts of the blood exuded from the mucous surfaces, and by exciting and calling into active and healthy action the functions of the secreting organs, particularly those of the abdomen. In order to attain this end, large doses of calomel, followed by purgatives or aperients, are required.

182. Calomel was commonly employed in India, and generally in conjunction with opium, in some form or other, and certainly few remedies succeeded better, either there or in Europe, in allaying the vomiting, when the disease was neither unusually severe nor too far advanced. In cases of moderate severity, and when given early in the attack, it seems to have been remarkably beneficial in restoring the secretions of the abdominal viscera, particularly of the liver; and in these, in conjunction with bleeding, it seems to have had no mean share in preventing the consecutive states of disease, into which this pestilence so frequently passed, more particularly the nervous, congestive, or malignant state of fever sometimes supervening. Mr. Ogilvy (*Bomb. Rep.*, p. 210) remarks,

that where the calomel affected the mouth, the consequent symptoms of bilious fever were not observed. Its good effects will be promoted by combining it, as above (§ 179), with camphor, carbonate of ammonia, and small, or at least moderate, doses of opium. Large doses of this last medicine are injurious in a disease, one of the chief characters of which is great depression of the vital energies.

183. If the means here detailed arrest the malady, or bring about reaction, the treatment must be greatly modified or altogether changed. If they fail of producing either of these effects, the additional means about to be recommended for the *third* form of the disease must be resorted to (§ 200, *et seq.*).

184. (*b*) The *third* stage,* or that of reaction, being brought about, the chief intentions of treatment are, 1st. To prevent it from proceeding too far; 2d. To promote the secretions, particularly those of the liver and kidneys; 3d. To guard internal viscera from the congestive, sub-inflammatory, and disorganizing states often attendant on this stage; and, 4th. To promote the return of the healthy functions of the alimentary canal.

185. The above objects are obtained by the cautious employment of blood-letting, either general or local, but more frequently the latter, in this stage of the disease, particularly if it have not previously been resorted to, or when it is clearly indicated, and when the pulse is not very soft, broad, and open—states which forbid blood-letting; by calomel exhibited in the states of combination already noticed, or with ipecacuanha; by aperients or purgatives, combined with gentle tonics and antispasmodics, and by vapour baths. If cerebral, typhoid, or nervous affection supervene, opium, unless in small doses, and combined with camphor, or with calomel also, seems to be contra-indicated.

186. In the stage of reaction attended by cerebral symptoms, particularly if the vessels of the conjunctiva be loaded, leeches should be applied to the posterior parts of the head and temples, and purgative medicines be employed with the view of removing the congestion of, and the determination to the head, and of increasing all the abdominal secretions and excretions; and external derivatives resorted to, in order to relieve the internal viscera from the load which oppresses them. In this particular state of the disease, as well as in its early stage, active enemata are especially indicated. They should be repeated, without being discouraged by the circumstance of their not being retained. The end will be obtained at last, if we persevere in a judicious manner. I have frequently seen marked advantage derived, in this state of the disease, from the subjoined formulæ:

No. 308. ℞ Asafœtidæ, ʒij.; camphoræ rasæ, gr. xii. tere cum decocti avenæ, ℥viij.; dein adde olei terebinth. ℥ss. ad ℥jss. Misce, et fiat enema.

No. 309. ℞ Olei terebinth., ℥j.; olei olivæ, ℥jss.; camphoræ rasæ, gr. xv.; decocti avenæ, ℥viij. M. Fiat enema.

187. Derivatives are of the utmost advantage in the state of reaction with dangerous cerebral affection. Belonging to this class of means, blisters and sinapisms have been most commonly resorted to, the former applied between the shoulders, the latter over the epigastrium and insides of the thighs. M. RANQUE has strongly recommended certain rubefacient and irritating applications to the abdomen, and M. DE BOISMONT has approved of them. They are required equally during the first stage, particularly when the vomiting and spasms are very urgent, and during this period when the head is much affected. Of this class of means, the warm turpentine embrocations applied to the abdomen and insides of the thighs, as noticed above (§ 180), are to be preferred, as being most quick and decided in their operation. The liniment already mentioned (§ 179), or the former of the two prescribed below,* may likewise be assiduously rubbed over the spine and lower extremities; the latter on the insides of the thighs only, as it is more apt to remove the cuticle than the former. When the turpentine fomentation is not used to the abdomen, the liniment may be applied to this situation. In this period of the malady the *kidneys* may not sufficiently discharge their functions, although this is not so frequently or constantly observed as in the severer grades, where this condition is one of the most dangerous that presents itself, and the most difficult to remedy. When, however, it does occur, the embrocations and liniments already mentioned should then be applied to the loins.

188. When the stage of reaction is accompanied with gastro-enteric affection, or with the additional complication of marked affection of the liver, or disturbance of its functions, or if it assume the nearly allied form of bilious fever, the external medicaments recommended above are also requisite. If the stomach and bowels are chiefly affected, the application of leeches to the epigastrium will be necessary previous to the employment of these, or of other external or internal means; and emollient injections should be occasionally thrown up. Small doses of opium, combined with camphor and the blue-pill, or the hydrargyrum cum cretâ, may also be given from time to time.

189. Very nearly the same treatment as now stated is required when the symptoms indicate a congested or sub-inflammatory state of the liver. The application of leeches to the epigastrium and right hypochondrium; full doses of calomel given at bedtime, combined with small quantities of camphor, and an aperient draught the following morning, or a few hours afterward; the use of warm diaphoretics at short intervals; aperient and emollient injections, and the external means recommended above (§ 187), will generally be requisite.

190. If the consecutive affection assume a dysenteric character, leeches to the perinæum or sacrum, emollient and diaphoretic medicines, and mucilaginous injections will be found extremely serviceable. As the dysenteric form of the stage of reaction is frequently either associated with, or dependent upon, a very acrid and otherwise morbid state of the secretions poured into the bowels, and sometimes on an affection of the liver, the occasional exhibition of a dose of calomel with JAMES's powder, and

* See note, p. 124, supr.

* No. 310. ℞ Linimenti saponis co.; linimenti camphoræ co., āā, ℥jss.; olei terebinth., ℥ij.; saponis duri, ʒij.; olei limonis et olei cajeputi, āā, ʒjss. M. Fiat linimentum.

No. 311. ℞ Camphoræ, ʒij.; solve in tinct. cantharid. et Tinct. capsici, āā, ʒij.; dein adde linimenti sapon. co., ℥ss. et gradatim, miscendo, liquoris ammon., ʒvj.; olei olivæ, ʒx. Misce, bene ei sit linimentum.

the use of aperients, will be indispensable, in addition to the other internal and external means of cure already particularized.

191. When the stage of reaction is attended with pulmonary affection, local depletion, and the exhibition of those medicines which, while they increase the secretions of the skin and the abdominal viscera, occasion a derivation of the blood from the congested organ, will then be necessary. The most energetic of those are calomel, or the blue-pill, with ipecacuanha, camphor, and hyoscyamus, followed by active purgative draughts and injections, and the application to the insides of the thighs of the liniments or embrocation already prescribed. In these cases the decoction of senega may be given with emollients and aromatics, or the ammoniacum mixture, with liquor ammoniæ acetatis, the camphor mixture, the spiritus ætheris nitrici, and the vinum ipecacuanhæ.

192. Upon the whole, the treatment of the stage of reaction in its various forms of manifestation, as well as the state of *collapse* into which it so rapidly passes, must be directed according to sound views of morbid actions, of therapeutical indications, and of the operation and appropriate application of remedies, as in similar or analogous cases and circumstances of disease. As to the treatment of the *last period* of the malady, or that of collapse, it will be preferable to defer any remark until some notice has been taken of the treatment of the more violent forms of attack.

193. *B Of the Treatment of the severer Grades of the Disease.*—The same objects or intentions of cure as have been recommended for the slighter grade of the malady (§ 176) will be applicable to the early periods of the severer grades, and very nearly the same agents will be required to fulfil them.

194. Here, also, I recommend astringents and stimulants, and upon the same grounds, with the same views, and in the same or similar forms of combination as those already described (§ 177). If the astringents chiefly confided in, more especially the sulphate of zinc, occasion or increase vomiting, the circumstance is not to be regretted. In some cases it may even be promoted, with the view of equalizing the circulation and overcoming visceral congestions. In young, robust, or plethoric persons I would even propose a moderate venesection, at the same time that vital resistance and reaction are promoted by stimulants and external derivatives; by it the load which oppresses the springs of life, and prevents their reaction, is lightened, and the mass to be moved is thereby brought to a nearer relation to the state of the moving power. But while the mass to be moved is thus reduced, care must be taken to rouse the moving power by a judicious administration of stimulants, of which full vomiting, excited by the means already noticed, the application of external heat (§ 178), hot epithems and fomentations on the abdomen (§ 179), and frictions with hot liniments or warm cloths (§ 180), are among the most efficacious.

195. Blood-letting, however, should not be attempted in persons who are advanced in life, in the debilitated, the previously ill-fed, the drunken, and in those inhabiting low, marshy, and unwholesome situations, or who live chiefly on a poor vegetable diet. Even in those from whom the abstraction of blood is admissible, the strength, habit of body, the previous health of the patient, as well as the state and progress of the disease, should be duly considered, the effects of the loss carefully observed, and the quantity cautiously regulated accordingly. Blood-letting ought never to be attempted where there appears evidence of the loss of a large portion of the serum of the blood from the alimentary canal, or when the pulse at the wrist is small and weak. At the time of its being instituted, as well as afterward, and in those cases where it should not be practiced, internal medicines should be administered, in addition to the external means already noticed, in order to rouse the energies of the nervous and vascular systems; and thereby, while the second and third intentions of cure are being fulfilled, congestion will also be removed. Of the various internal stimuli which have been recommended—and almost every one in both the mineral and vegetable kingdoms of nature has been tried—the most eligible, and, I believe, the most successful, are camphor in large doses, opium, ether, the preparations of ammonia, the aromatic and essential oils, particularly the oils of peppermint, cloves, cajeput; the spirits of mint, lavender, cardamoms, &c.; solutions of phosphorus in ether, or in oil;* the magistery of bismuth; large doses of musk; the hot spices, and numerous warm and aromatic plants, in various forms of combination, &c. Most of those may be conjoined with the astringents already recommended (§ 177), and taken either in the form of pill or mixture. In many cases it will be advisable to give also stimulating beverages, especially those to which the patient has been most habituated, as any of the several spirituous liquors diluted with warm water, sugar, &c.; hock, Champagne, sherry, or Madeira wine in Seltzer, soda, or potash water. In this state of the disease, particularly when the depression of the vital energies is extremely great, the assiduous application of the turpentine fomentation to the abdomen, as well as of the hot liniments to the insides of the thighs (§ 179, 180), and the administration of injections, as stated above (§ 186), in conjunction with the internal exhibition of the stimulants now mentioned, will also be requisite, and, when appropriately prescribed, will often prove highly beneficial.

196. It is unnecessary to enter farther into detail as to the treatment of the early stage of the severer grades of the pestilence. It may, however, be remarked, that in addition to the medicines already noticed, others have been employed. Among these the most deserving of mention are, musk in large doses, with camphor or ammonia; infusion of valerian with camphor or asafœtida, particularly as an enema; the decoction of guaiacum, in a similar combination and mode of exhibition; warm infusions of rosemary, mint, and lavender, with spirit of nitric ether; and various other vegetable infusions and essential oils. They may be exhibited either by the mouth or in enemata.

* No. 312. ℞ Phosphori, gr. j. ad ij.; solve in æther. sulphur., ʒiij.; olei terebinth., ʒij., et adde olei olivæ, ʒij., ss.; pulv. gum. acaciæ, ʒj.; aquæ menth. pip., ʒiv.; olei cajeputi, ℥xii.; syrupi zingiberis, ʒj. Misce secundum artem. Capiat cochlearia ij. larga omni bihorio.

197. (*b*) When imperfect *reaction* occurs—for reaction is seldom or ever freely and openly developed—it presents the same manifestations, in respect of vital organs, that have been already described (§ 184, *et seq.*); and the treatment, which has been recommended as appropriate to each of the states in which this stage of imperfect reaction shows itself, is equally applicable here, and is directed to the accomplishment of the same intentions as in the first or slightest grade of the malady. The typhoid state of fever, which frequently presents itself, requires the remedies described above (§ 186, 187); and the congestive and sub-inflammatory states of the liver (§ 189), stomach, bowels (§ 188), and lungs (§ 191) generally demand the means which are applicable to them respectively. In this state of the malady the secretion of *urine* is very generally suspended, or at least is very scanty, especially when the discharge of serous fluid from the bowels has been abundant, the blood being incapable of furnishing the fluid material of urinary discharge. The chief object of treatment is, therefore, to change the morbid condition of the circulation by means of the secreting viscera, and by furnishing the stomach with a sufficient quantity of medicated or simple diluents, whence the inordinate loss of the serum of the blood may be replaced, and the functions of secretion supplied and promoted. At the same time that these views are being acted upon, those organs which suffer congestion and a sub-inflammatory state of action, arising from the depressed state of the vital powers and the morbid condition of the blood accumulated in or circulating through them, must be, as far as possible, preserved from disorganization. This latter object is best attained by cautious local depletions, by rousing, and, at the same time, controlling the functions of the different emunctories, by expelling morbid matters from the prima via, and transferring irritation to parts which cannot be materially injured by it.

198. In this, and, indeed, in all stages of the disease, as long as the sensations of heat at the epigastrium and thirst are complained of, the patient should be allowed such fluids or beverages as may prove most grateful to him; and these may be made the vehicle of the medicines already advised, and taken at a temperature which is most agreeable to him—generally in small quantity at a time, and frequently. I have often allowed fluids to be taken, either cold or slightly warm, with small quantities of the nitric and hydrochloric acids, when the medicines given at the time were not chemically incongruous with them. The Anglo-Indian practitioners have lauded these beverages; but I have experienced but little benefit from them unless during convalescence, when they tended to restore the torpid functions of the liver. During the period of imperfect reaction I have found more benefit result from a liberal use of diluents containing liquor potassæ, or the alkaline carbonates, or the bihorate of soda; these appearing to favour the passage of fluids into the circulation, to correct the state of the blood, and to excite the action of the kidneys.

199. During the consecutive fever, as well as at an early period of convalescence, the bowels may become torpid, and require warm stomachic aperients, such as the decoctum aloes compositum with a little cinnamon water; equal parts of the compound infusions of gentian and of senna, or the mistura gentianæ composita; and any of the preparations of mercury which the state of the patient may suggest. The "*droque amère*,"* a tonic aperient tincture long used among the Jesuit missionaries in the East, obtained much reputation in this period and grade of the pestilence, as well, indeed, as in all its grades and stages, where a stimulating aperient was indicated, and was much employed by Anglo-Indian practitioners: it was generally given in doses of half an ounce to an ounce, in camphor water, or in any suitable vehicle.

200. *C. Treatment of the Third, or most intense Grade of the Malady.*—In this grade the depression of the energies of the frame is as profound as is consistent with the continuance of life. The means of cure, therefore, ought to be most promptly administered, and energetically devised. The objects proposed to accomplish them are in every respect the same as were stated when treating of the stage of depression in the slighter grade of the disease (§ 177); but still more energetic agents are requisite to attain them than have yet been recommended, and most frequently even the most active we can devise are entirely unequal to the accomplishment of the ends we wish to attain. Indeed, the vitality of the several organs is so extremely depressed as to be incapable of being influenced by any moderate agent; the structures are far advanced to the state presented by them immediately after death; and the blood is no longer capable of being circulated. Treatment is, therefore, entered upon with feelings of despair; still, as recovery from this state does occur in rare instances, it is our duty to employ rational means to attain this end as long as life continues.

201. In this grade of the malady the stimulating *emetics* already recommended (§ 177), with the view of exciting full vomiting, which the powers of the constitution are of themselves incapable of effecting, should be employed early, if at all, with the intention of producing reaction; using at the same time stimulating frictions, the turpentine fomentation to the whole abdomen, as hot as it can be made; the hot-air bath, and the internal stimulants already prescribed (§ 195), or some of those about to be noticed (§ 203).

202 Blood-letting is advised by some writers as early as possible in this grade of the malady, and denounced by others. My own experience and that of many practitioners in this country are decidedly against its adoption.

[Emetics and blood-letting invariably proved injurious in the treatment of cholera, so far as we have observed. If bleeding is practiced at all, it should be at a very early stage of the disease; but at that period we have other remedies equally successful, and on all accounts less

* No. 313. ℞ Aloës socot., ʒiv. vel ʒv.; gum. myrrhæ, gum. mastiches, benzoini, āā, ʒij.; rad. calumbæ concis., rad gentianæ, āā, ʒij.; croci stigmat., ʒj.; spirit. vini Gal., ibix.; spirit. vini Hollandiæ, ibiij. Macera per mensem, exprime et cola. This excellent tincture furnishes an illustration of the principle, first clearly explained and inculcated by Hoffmann, that purgatives, particularly aloes, have their purgative action greatly increased by being combined with bitters and tonics.

objectionable. The vital forces are not to be reduced, by loss of blood or any other debilitating evacuation, if it can be avoided. The vapour bath is a remedy of decided efficacy in the early stages of this disease, and may be depended on with more confidence than almost any other remedy. We have treated many cases successfully with no other means whatever, allowing the patient to keep warm in bed, and take rice or barley gruel, or chicken water. Cathartics are unsafe, unless those of the mildest description; antimony in any shape is poisonous. The same remark will apply to the more irritating articles of the cathartic class.]

203. When the means already noticed fail, or seem inadequate to arrest the violence of attack, others which have sometimes succeeded in similar states of morbid action, particularly when they cannot prove detrimental, should be prescribed. I would, therefore, recommend a bolus, consisting of from ten to fifteen grains of camphor, an equal number of grains of calomel, two grains of Cayenne, one grain of opium, and ten drops of any essential oil, as of mint, cajeput, &c., to be given with a sufficient quantity of conserve of roses. This may be administered after full vomiting, if it can be quickly procured, but without any regard to its continuance. If this bolus be retained, another may be given, and repeated in from one to two, three, or four hours, according to the urgency of the attack; but if rejected, it should be immediately repeated, until it at last remains. Not more than three or four of those boluses ought to be given, and frequently two will be sufficient.

204. Simultaneously with the administration of the above, thirst should be quenched by a frequent recourse to whey, to Seltzer water or soda water with milk, by spruce-beer, or by other diluents; and dry heat may be employed, and the turpentine fomentation applied, as hot as possible, to the abdomen and chest; and friction of the spine and thighs with any of the liniments prescribed above (§ 187), made warm by plunging the vessel containing it in hot water, resorted to. From one to three hours after the exhibition of the bolus, a draught, consisting of from two drachms to half an ounce each of spirits of turpentine and castor-oil, or of olive-oil, with a few drops of the above essential oils, and forty grains of magnesia, should be taken in mint water; and if it be rejected, another should be given, and repeated; if again rejected, in half an hour afterward; if retained, not until from six to twelve hours, when another may be taken. I have seen cases where the most urgent vomiting existed, and yet the above remedies (although both the bolus and the draught were taken at the same time) allayed, instead of aggravating, this symptom. Besides, it is our object to obtain full vomiting at first; therefore this cannot be viewed as an unfavourable operation of the medicine, if it should follow the exhibition of the first doses of it. In order to promote the influence of these means, a lavement, consisting of ten to twenty grains of camphor, or a drachm of asafœtida, half an ounce to an ounce and a half of the spirits of turpentine, and an equal quantity of olive-oil, in a suitable vehicle, should be administered, and repeated according to the circumstances of the case. Much will depend upon the succession in which these remedies are given, the periods which are allowed to elapse between their exhibition, and on the doses and the decision with which they are prescribed. The hot turpentine fomentation, assisted by hot air and frictions with stimulating substances, is the most powerful means I am acquainted with of procuring reaction, restoring the heat of the body, and relieving the viscera from congestion.

205. The internal remedies now recommended, as well as the external means so frequently insisted upon, have been employed by me in many hundred instances of malignant and extremely dangerous diseases, and I have found them the most efficient of all others with which I am acquainted, when judiciously combined and administered, in rousing the energies of life, restoring the secretions, removing the congestion of internal organs, and in subduing that unhealthy sub-inflammatory state of action which often occurs in fevers, and in diseases proceeding from infection and animal poisons, and which generally advances rapidly to fatal disorganization. In aid of the above remedies, and particularly when the energies of the constitution seem to react, although most imperfectly, *effervescent draughts* with the sesquicarbonate of ammonia, and the pyroligneous acetous acid in mint or cinnamon water, or in an infusion of cloves, the ammonia being in excess, may be given from time to time, and a *large blister* applied over the epigastrium upon the removal of the turpentine epithems.

206. I would also recommend, both in this most severe grade of the malady, and that next it in degree, the administration of medicinal substances in the state of vapour, and medicated gases through the channel of the respiratory organs. It has already been shown that it is through these organs that the specific cause of the disease invades the frame, and that they suffer in a most remarkable manner from its impression, having their functions altogether paralyzed, and their substance remarkably congested at a more advanced stage. If this view be entertained, the means of individual prevention which are hereafter recommended will appear the more deserving of adoption, and the directing of medicinal agents to this quarter will, at least, not be considered unreasonable or undeserving a fair trial. Perhaps the inhalation of the nitrous oxide gas, or common air with a slight addition of oxygen, will be the most energetic remedies that can be employed in this way. Other means, also, which will readily suggest themselves to the well-informed physician, may be used; and among others, the vapour arising from gently heating a strong solution of camphor in aromatic vinegar, or the vapor of the aromatic preparations of ammonia, may be mentioned; and shocks of galvanic electricity may be passed through the chest.

207. Besides the use of frictions with hot cloths, or dry substances, or with liniments, which will not occasion cold by their evaporation—means which have already been advised—the application of hot air, or of hot salt or bran, or hot oats, around the body, have all been recommended. In cases where the hot turpentine fomentation, or common sinapisms, have no effect, or in this most intense grade of the malady, without waiting for the effects of less active means, the subjoined cataplasm* may

* No. 314. ℞ Pulv. sinapeos, ℥ss.; pulv. capsici annui,

be applied over the abdomen. A trial may also be given to medicated vapour baths; to baths, with the fumes of some of the volatile essential oils extricated by heat; and to dry-cupping in the course of the spine, with the view of removing congestion within the spinal canal, as well as of the kidneys and other parts. It may be remarked, that in the most severe attacks, or when far advanced before medical aid is procured, scarcely any means, however well and energetically devised and practiced, will prevent a fatal result; while the less severe visitations will generally be removed by any of the remedies enumerated, when judiciously combined and employed. There is reason to suppose that the slightest grade of the malady will even, by means of the vomiting and tumult excited in the frame, operate its own cure; and hence the reputation acquired by various mild or inefficient medicines and methods of treatment. There are few diseases, perhaps, which, while they preserve a perfect identity of character, present a greater range in grade than this; excepting, indeed, those maladies which propagate themselves in a similar manner to it. Indeed, it is chiefly to the mildness of the attack that we are to attribute the imputed success of such remedies as successive draughts of warm milk, olive-oil, the GLAUBER salts, common salt, and various other mild preparations. In the more intense visitations, where the depression of the vital energies of the frame and the vitiation of the blood are extreme, remedial agents should possess a co-ordinate degree of activity, in order to produce any effect whatever on the system.

208. If the above energetic means be judiciously put in practice, and brought to act simultaneously on different parts of the body, or prescribed in due succession and states of combination, as the scientific, zealous, and experienced practitioner may consider appropriate to the grade and stage of the malady, signs of reaction will sometimes manifest themselves; and then—particularly if it have not previously been employed, or when the state and circumstances of the patient furnish no reason against it—a small blood-letting, either general or local, may be cautiously resorted to. If the stage of reaction be brought about, however imperfectly, the same intentions of cure, and the same measures to fulfil them, which I have already described when treating of the various manifestations of this stage in the less intense grades of the malady, should be appropriately employed against each of them respectively, as they may supervene in this most severe form of the pestilence, although success from the most active and judicious measures can seldom be expected in this stage of the malady, more especially if the urine still continue suppressed, or means to supply the lost serum of the blood be still unavailing.*

209. As the exhaustion of strength is extreme, and as every muscular effort increases it, and as fatal syncope may soon occur in the most severe grades, from being raised to the erect, or even sitting posture, means ought to be adopted to preclude the necessity of the patient's removal from the recumbent position for the purposes of evacuation. The discharges should be received in a bed-pan; and when medicines are exhibited, his head and shoulders should be raised no higher than is requisite to the accomplishment of the object. Mr. SEARLE very justly remarks, that attention to this injunction cannot be too strictly enforced, and states that two patients under his own observation lost their lives from neglecting it.*

210. It not unfrequently happens that the active stimulants which we prescribed in the stage of depression, particularly in the more intense grades of the malady, together with the natural tendency of the disease, occasion inflammation, or a sub-inflammatory state of the stomach and bowels. When this occurs, the epigastrium and abdomen become extremely tender, and even tumid. Great irritability of the stomach is also present, and is increased after the ingestion of stimulating substances. In cases of this kind, venesection, the application of leeches, followed by the hot fomentation or the cataplasm prescribed above (§ 179, 207), and, upon their removal, by a large blister; the exhibition of calomel combined with small doses of camphor and opium; purgative or aperient injections, often repeated, and sinapisms or stimulating liniments to the lower extremities, are among the chief remedies.

211. In the treatment of this as well as of the following stage, all means will prove inefficacious as long as the *urine* is either suppressed or secreted in very small quantity. The defect of this excretion proceeds rather from the want of serum in the blood, than from a paralyzed or congested state of the kidneys; therefore the beverages already advised (§ 195, 198) should be freely administered, and he made the vehicle of medicines in order to supply the loss, and dry-cupping followed by stimulating embrocations applied to the loins.

212. *D. Treatment in the Last Stage, or that of Exhaustion and Collapse.*—In those cases in which efforts at reaction, or consecutive excitement, are manifested, exhaustion often rapidly supervenes, owing to the depressed and weak powers of life, to the morbid state of the circulating fluid, and the deficiency of serum. Hence the necessity, during the imperfect manifestation of excitement or reaction, to support the powers of life, even while we have recourse to small general or local depletions, to allow a free use of whey, or other diluents containing saline substances, as Seltzer and soda water, and to act upon the secretions by means of

pulv. zingiberis, āā, ʒj.; acidi acetici pyrolignei q. s. ut fiat cataplasma, dem adde olei terebinthinæ, ʒij. Misce.

The following compound tincture of camphor and opium seems well suited to the worst grades of this malady, in doses of one or two drachms, given in any suitable vehicle.

No. 315. R Opii pulveriz., ʒiij.; camphoræ, ʒvj.; corticis canellæ contusi; croci stigmat., ʒij.; caryophyllorum; pulv. capsici, ʒjss.; potassæ sub-carbon, ʒij.; olei anisi, ʒj.; spirit. vini tenuior. (vel sp. vin. Gallicæ, vel sp. vin. Hollandiæ), Oij. Macera leni cum calore, per dies viij. ad xii.; dein exprime et cola.

[* It is questionable if the vitiation of the blood, after it has separated or disunited the crassamentum or serum to a certain degree, can ever again be so repaired as to render it possible for the vital fluid to reabsorb any substance whatever that may be introduced into the alimentary tube, or otherwise to supply the lost serum.—T.]

[* In connexion with this subject, it may be remarked, both in this disease and in yellow and other infectious fevers, that a great number of cases are made to have a fatal issue by neglect of such injunctions, and by removing patients when in this extreme state from one locality to another, as often happens in transporting them from the place where they are seized to the quarantine or lazaretto, &c. —T.]

purgatives given by the mouth, and in the form of injections; hence the propriety of removing the local determinations and congestions with which the attempts at reaction are more or less accompanied, by means of external derivatives and counter-irritants, employing tonics at the same time that we endeavour to restore the suspended secretion, and thereby to purify the blood, and to derive it from the seats of congestion. It is obvious, however, that these ends cannot be attained while the physical condition of the blood is such as not to admit of secretion or even of due circulation, while the blood is deprived of one half of its due quantity of serum. Therefore, due care should be taken to administer, by the mouth, and by injections, suitable diluents, and to persist in the exhibition of them, especially of those already mentioned (§ 195, 198), in hopes that a portion of them will be carried into the circulation, and supply the deficiency of the watery portion of the blood.

213. As all attempts at reaction must necessarily soon lapse into profound exhaustion, when made during inordinate depression of the powers of life and a morbid state of the blood, characterized, not merely by loss of the serum, but also by an accumulation of urea, carbon, and other effæte materials requiring removal by the several emunctories, so the objects entertained should be to supply a due quantity of fluid to the circulating mass, and to conjoin with, or dissolve in, that fluid, such substances as will most powerfully and readily excite the action of the excreting viscera, particularly the kidneys and liver, and thereby remove the impurities accumulated in the blood. We ought, therefore, to resort to these means as early as possible, and in such modes and combinations as are best calculated to attain these objects. If, however, exhaustion proceeds rapidly, stimulants and permanent tonics, given internally; antispasmodic and tonic injections; hot air, hot cataplasms and fomentations; and the other internal (§ 195, 207) and external stimulants, described when treating of extreme depression, occurring early in the disease (§ 201–203), may be resorted to. Yet the vital depression will never be removed while the urine is suppressed or scanty, without administering diluents as advised above (§ 204), and saline purgatives and aperient enemata. It is in this state of the disease that the warm tonic and purgative medicines prescribed above (§ 199) prove most serviceable, and that the patient requires to have his energies kept up by light nourishment, by grateful diluents and beverages, with a moderate quantity of wine, which latter may also be administered occasionally with injections.

214. In the more extreme cases of this stage of the disease, oil of cloves, or of mace, or of rosemary, or of British juniper, or of rue, or lavender, to be applied warm, over the abdomen or epigastric region, and allowed to remain there, or to be renewed, according to the effect produced. In the more urgent cases, a cloth moistened with the warm oil may be placed in this situation, and kept closely applied by means of a compress, which will tend to prevent its rapid dissipation. In milder cases the oil may be combined with camphor and some one of the plasters in common use, as the galbanum, the pitch, or ammoniacal plaster, and these applied and renewed from time to time. I have seen, in cases of extreme vital exhaustion, with depression of the animal warmth, from other causes, the skin of a recently-killed animal, particularly that of a sheep, wrapped round the body of the patient, the wool outward, and advantage derived from the application. Even this or similar means may be tried as a last resort.*

215. *D. During convalescence* from this disease, care should be taken to prevent relapses. It is very frequently observed that at the commencement of convalescence, the patient is tormented with an uncommon craving for food. This should be restrained, and but little, or at most a moderate quantity only, and of a light, digestible kind, allowed to be taken. The se-

* I have adverted, in another part of this work, to the influence of the animal warmth of young healthy persons on those who are debilitated, or are labouring under extreme exhaustion. Since that was written, I chanced to find this mode of treatment strongly insisted upon by Sydenham (*Observat. Med.*, i., 4, § 40), and as follows, in the "*Medical Notes and Observations*" of Sydenham, just now published for the first time by Dr. Greenhill, of Oxford, the learned editor of his works:

"*De Methodo medendi Morbos per Accubitum Iunioris. Cap.* 16. May ye 19th 1662 I was called in ye night to Mrs Change, whom I found very ill of a Cholera Morbus; she had many ugly Symptoms, as coldness of the Extreme parts, talking a little idly, intollerable Sickness, & felt a tingling in her Fingers & flesh outwardly. I judge it dangerous to use Dilutients especially by Clysters in a Women [*sic*] soe green (she having not lain in a Month) & ye Disease pressing soe hard upon my heels; Soe I orderd her to take a warm Cordial, & that a good draught of it, & her Husband to lie close to her Back naked, and her sonn of 12 years close to her Belly, & to lay on more Cloths & to warm her Leggs & Hands with hot Cloths: She immediately fell into a moderate Breathing, & all Sympt. ceased: & after enjoyning her to keep her bed ye next day, & to eat & drink nothing save a small Quantity of Barly-broth a day for 2 days she perfectly recoverd.

"February 1661 I was called to Mrs Hulston, who after a very Chronical fever was fall'n into a very fatallike Diarrhea; I saw it was to noe purpose to give astringents seeing ye Disease proceeded from a Decay of natural heat, therefore I took this Course, viz. I caused her Sonn a plump hot Lad of 13 years of age, & her Nurses sonn of 6 or 7 years to goe to bed to her naked, & to lie ye one close to her Belly, ye other close to her Back, wch they did, & as long as they continued wth her she had noe stools: but ye Boys rising at any time ye Looseness would immediately return. I commanded that she should persist in ye Course till her cure should he compleat, (the Boys relieving one another by turns in ye daytime) & soe she fully recoverd not only of her Looseness but allso of her Sickness in generall.

"The very same course I took with one Mr Little, who had a fever abt 7 weeks, & at yt time Aug. 1662, soe far spent yt his Drs judged him a Dead-Man: He was ancient & having been much purged wth violent Medicaments, he was as weak as ever I saw any yt recoverd; I (having to noe purpose made attempts to lay his fever by inward Medicines & to raise his strength hy Cordials) told his wife that nothing could preserve his life but ye putting a Boy to bed to him: soe she procured a Link boy to lie very close to him all night, & ye next morning I found his fever allmost off, & his Eye & Countenance more lively, upon wch I pronounced all danger to be over, yett afterwards upon my giving him a Clyster & upon ye recess of ye Boy he began to relapse; but ye Boy being gott again & I giving noe more Clysters he perfectly recoverd.

"The very same way had I cured before Bp. Monk's Lady, who was an aged Woman of a very feeble & thin habit of Body, & had an Ague wch (tho' gone) had soe weakend her yt her Physician Dr. Ridgley looked upon her as dead; when I was sent for she had allso spitten some purulent matter & blood wch they shewed me (in abundance) upon ye Napkin. I told ye Dr yt I apprehended yt nothing could save her life, but a speedy transplantation of some young Spirits upon her, to wch he readily agreed, & a Girl of 13 years was put in close to her Breast, upon this she recoverd very speedily both of her Unspiritedness & her Coughing: But ye Girl fell sick, wch was attributed to her lying wth ye Lady, tho' I was confident to ye Contrary, having never known any Mischief yt way; however she had first coming out upon her Petechiæ, & afterwards large Ulcers upon her Breech; But Dr Ridgley & I recoverd her."

vere nature of the attack, the derangement of the digestive mucous surface, and the disturbance accompanying it of all the digestive organs, must necessarily leave them for a time incapable of discharging their functions in a regular or active manner. They should, therefore, have no more imposed upon them than they seem capable of performing.

216. It frequently happens that, owing to neglect of this precaution, and occasionally to too early exposure to the vicissitudes of season or of weather, or to cold, chills, or wet, after an attack of this malady, a relapse occurs and carries off the patient. Care, therefore, should be taken to protect the surface of the body, and particularly the extremities, from cold during convalescence, to regulate the diet and regimen of the patient, and to promote the return of the healthy action of the stomach, bowels, kidneys, and other secreting viscera. In order to accomplish this last object, gentle tonics will be necessary; and as the functions of the bowels generally require aid, this should be afforded by combining aperients with tonics, and by gradually increasing the quantity and nutritious quality of the food.

No. 316. ℞ Pilulæ hydrarg., ℈j.; Pilulæ aloës cum myrrha, ʒss.; Saponis Castil., gr. x. Fiant pilulæ, xii., quarum capiat binas alternis noctibus.

No. 317. ℞ Quininæ sulph., ℈j.; Pilulæ aloës cum myrrha; Extr. gentianæ, āā, ʒss.; Pulv. capsici, ℈j.; Olei caryoph., q. s. Fiat massa æqualis et divide in pilulas xxx., quarum capiat binas omni meridie; vel

No. 318. ℞ Infusi gentianæ co.; infusi sennæ comp., āā, ℥iij.; potassæ sub-carb., ʒj.; tinct. cardam. co., ʒss. M. Fiat mist. cujus capiat cochlearia, iij. vel iv., ampla, hora somni vel primo mane.

217. After the frame has been fortified to a certain extent by these means, and the functions of the bowels and the secretions are brought to a healthy state, the shower-bath or the salt-water bath may be employed, in order to bring about a complete restoration of the energies of the constitution. Whichever of the two kinds of bathing be adopted, active friction of the surface of the body should follow upon coming out of the hath, and moderate exercise be taken in the open air, either on foot or on horseback.

[In the United States the treatment of cholera has been equally various and unsuccessful as on the other side of the Atlantic. For example, the treatment pursued in the four cholera hospitals in this city, in 1832, was very different, corresponding with the pathological views of the physicians attached to them, and yet the lowest mortality was, perhaps, equally great as that generally observed in Europe.

Hospitals.	Cases.	Cured.	Died.
Greenwich Hospital . . .	350	204	146
Park Hospital	590	312	278
Rivington-st. Hospital . . .	410	231	179
Corlear's Hook Hospital. . .	281	93	184
Bellevue Hospital	447	232	315

Thus the mortality at the Greenwich Hospital, of all received, was 41·10 per cent.; of the Park Hospital, 48·60; Rivington-street Hospital, 43·60; Corlear's Hook Hospital, 65·40; Bellevue Hospital, 57·50.

There were local causes, however, which might account for the increased mortality at Corlear's Hook and the Bellevue Hospital, apart from any differences in the mode of treatment.

Among the various remedies employed were bleeding, opium, mercury, purgatives, emetics, ice, brandy, camphor, ammonia, ether, tobacco, external heat and friction, infusion of saline substances, non-purgative salts, sinapisms and blisters, asafœtida, enemata, &c. At one time in the Greenwich Hospital, frictions with strong mercurial ointment, incorporated with camphor and capsicum, were thought to prove more successful in certain cases of collapse than any other; but this was eventually found equally unsuccessful as the other methods previously employed. Indeed, the exposure, with the alarm and agitation caused by powerful friction, long continued, together with the dangers arising from over-mercurialization, counterbalanced any beneficial effects arising from the practice. We know of no one remedy adopted in the treatment of the disease in this city which deserves, from the results, to be ranked above all others.

Uncommon success in the management of this disease has been claimed for Dr. Cartwright, of Natchez, who states that he treated more than three hundred patients without a single death, by giving freely *calomel*, *capsicum*, and *camphor*. Dr. Dickson also speaks very favourably of these articles, especially of capsicum, which, he says, was the most relied on in the southern and southwestern parts of our country, often combined with morphine, quinine, ether, &c. The quantities of camphor, calomel, capsicum, and morphine were carefully adapted to the age of the patient and the apparent urgency of the case. We consider the evidence in favour of these remedies amply sufficient to entitle them to the first rank in the treatment of this fatal malady.

The indications are sufficiently obvious, viz.: to arrest the alvine evacuations; to relieve irritation of the gastro-intestinal membrane; to restore the suspended secretions; to equalize the circulation; to relieve the nervous disturbance; and to support the general strength. The most important indication, undoubtedly, is to check the escape of the serous portion of the blood into the intestinal canal, which is to be done by inviting the fluids to the external surface of the body by powerful sinapisms, and by internal astringents, of which capsicum, rhatany, tannin, acetate of lead, and opium are the most important. To meet the first indication, we think galvanism or electricity worthy of trial. A combination of calomel, capsicum, and morphine tends to check exhalation into the bowels, determines to the surface, relieves pain and irritation, and sustains a moderate, general, diffusive excitement. Calomel allays gastric irritation, especially when accompanied with the exhibition of ice, while it, at the same time, promotes the biliary secretion. We have oftener succeeded in checking gastric distress and vomiting by administering small pieces of ice, than by any other remedy. It should, however, be aided by a sinapism over the stomach, and by immersing the feet and legs in a strong, hot mustard bath. We have also derived very great benefit in these cases from small quantities of cold carbonic acid water, and the effervescing draught. Hot drinks should never be allowed. In the diarrhœa which ushers in a choleric attack, we found it sufficient to direct the patient to keep his bed, using the stimulating foot-bath, mustard to the bowels, and warm diaphoretic drinks, with, per-

haps, a little chalk mixture, or an occasional pill of calomel and opium. We treated about eighty cases of cholera, in the incipient stage, in this manner, in the orphan asylum of this city, without losing a patient. The diarrhœa was invariably checked by determining to the surface in the manner above mentioned. Two cases attacked in precisely the same way, previous to our attendance, speedily ran into collapse, and terminated fatally. In our own case we several times resorted to the same simple means, with the same results. Hence we cannot but regard the cholera as one of the most generally manageable diseases which we have to treat, provided it be taken early in hand. The stage of collapse, in which about half of our cholera patients were received into the hospital, is really the dying stage. Occasionally, however, when the epidemic influence is at its height, cases will occur which baffle all the resources of art. We have seen such march on to a fatal termination in the course of three or four hours, without being affected in the slightest degree by the most powerful remedies. Of several such cases, treated in conjunction with Prof. Paine, see *Med. and Phys. Commentaries*, vol. iii. For a very full and satisfactory account of the disease as it prevailed in this city, including pathological appearances, treatment, &c., see the above very able work, *passim*. Also, on the treatment, Wood's *Practice of Medicine*, vol. ii., p. 664.]

Bibliog. and Refer.—Reports on the Epidemic Cholera which has raged throughout Hindostan and the Peninsula of India, since August, 1817. Published by the authority of Government. 8vo. Bombay, 1819.—*J. Jameson*, Report on the Epidemic Cholera Morbus, as it visited the Territories subject to the Presidency of Bengal, in the years 1817, 1818, and 1819. Drawn up by order of the government, under the superintendence of the Medical Board, 8vo. Calcutta, 1820.—*W. Scott*, Report on the Epidemic Cholera, as it has appeared in the Territories subject to the Presidency of Fort St. George. Drawn up by order of the government, under the superintendence of the Medical Board, folio. Madras, 1824.—*Corbyn*, Medico-Chirurgical Transactions, vol. xi., part i., 1820.—*R. Orton*, An Essay on the Epidemic Cholera of India, 8vo. Madras, 1820. Second Edition, with a Supplement. London, 1831.—*J. J. Deville*, Mém. et Observat. sur l'Epidémie de Choléra Morbus qui a régné au Bengale pendant l'été de 1818, 8vo. Lugd. Bat., 1819.—*J. Boyle*, A Treatise on the Epidemic Cholera of India, 8vo. Lond., 1821.—*A. Moreau de Jonnes*, Notice sur la Maladie Pestilentielle importée aux Iles de France et de Bourbon, et designée sous le nom de Choléra Morbus de l'Inde, 8vo. Paris, 1821.—*T. Brown*, On Cholera, more especially as it has appeared during late years in British India, 8vo. Edin., 1824.—*W. Ainslie*, Observat. on the Chol. Morb. of India, 8vo. Lond., 1825.—*J. Annesley*, Sketches of the most prevalent Diseases of India, comprising a Treatise on the Epidemic Cholera of the East, &c., 8vo. Lond., 1826; sec. ed., Lond., 1831.—*R. H. Kennedy*, Notes on the Epidemic Cholera, 8vo. Calcutta, 1827.—*A. T. Christie*, Observations on the Nature and Treatment of Cholera, 8vo. Edinb., 1828.—*L. J. M. Robert*, Guide Sanitaire des Gouvernemens Européens, ou Nouvelles Recherches sur la Fièvre Jaune et le Choléra Morbus, &c., 8vo. Paris, 1826.—*B. Hawkins*, History of the Epidemic Spasmodic Cholera of Russia, &c., 8vo. Lond., 1831.—*L. Bodin*, Précis sur le Choléra Morbus, et sur la Contagion, &c., 8vo. Paris, 1831.—*H. Ranque*, Mémoire sur un Nouveau Traitement du Choléra Morbus, et des Affections Typhoides, &c., 8vo. Paris, 1831.—*C. Searle*, Cholera, its Nature, Cause, and Treatment, clearly and concisely explained. Second edition, 8vo. Lond., 1831.—*G. H. Bell*, A Treatise on Cholera Asphyxia, or Epidemic Cholera, as it appeared in Asia and in Europe, 8vo. Edinb., 1831; and Letter to Sir Henry Halford, Bart., &c., on the Tendency of the proposed Regulations for Cholera, on the Nature of the Disease, &c. Edinb., 1831.—*H. Young*, Remarks on the Cholera Morbus, its Symptoms, Causes, and Treatment, &c., 8vo. Lond., 1831.—*J. R. Lichtenstædt*, Die Asiatische Cholera in Russland in den Jahren 1830 und 1831, &c., 8vo. Berlin, 1831.—*J. Goss*, Practical Remarks on the Disease called Cholera, now existing on the Continent of Europe, 8vo. Lond., 1831.—*G. W. Lefevre*, Observations on the Nature and Treatment of the Cholera Morbus, now prevailing epidemically in St. Petersburgh, 8vo. Lond., 1831.—*T. J. Pettigrew*, Observations on Cholera, comprising a Description of the Epidemic Cholera of India, the Mode of Treatment, and the Means of Prevention, 8vo. Lond., 1831.—*Briere de Boismont*, Relation Historique et Médicale du Choléra Morbus de Pologne, comprenant l'Apparition de la Maladie, ses Progrès, ses Symptômes, son Mode de Traitement et les Moyens Préservatifs, 8vo. Paris, 1831; Observations sur le Choléra Morbus, recueillies et publiées par l'Ambassade de France en Russie, 8vo. Paris, 1831.—*F. G. Boisseau*, Traité de Choléra Morbus, considéré sous le Rapport Médical et Administratif, ou Recherches sur les Symptômes, la Nature, et le Traitement de cette Maladie, et sur les Moyens de l'éviter, 8vo. Paris, 1831.—*F. E. Fodéré*, Recherches Historiques et Critiques sur la Nature, les Causes, et le Traitement du Choléra Morbus d'Europe, de l'Inde, de Russie, de Pologne, &c., spécialement appliquées à l'Hygiène Publique, 8vo. Paris, 1831.—*A. Moreau de Jonnes*, Rapport au Conseil Supérieur de Santé sur le Choléra Morbus, les Caractères et Phénomènes pathologiques de cette Maladie, les Moyens curatifs et hygiéniques qu'on lui oppose, son Mode de Propagation, &c., 8vo. Paris, 1831.—*M. Bunavi*, Trattato delle varie Specie di Cholera Morbus, 8vo. Turin, 1831.—*P. F. Kerauden*, Mémoire sur le Choléra Morbus de l'Inde, 8vo. Paris, 1831.—*C. Horn* et *G. Wagner*, Instructions sur le Choléra Morbus, contenant les Moyens de s'en préserver, d'en guérir, et d'empêcher sa propagation. Traduite par *M. L. Paris*, 8vo. Paris, 1831.—*Desruelles*, Précis Physiologique du Choléra Morbus, &c., &c., 8vo. Paris, 1831.—*Larrey*, Mémoire sur le Choléra Morbus, 8vo. Paris, 1831.—*B. Zoubroff*, Observations faites sur le Choléra Morbus à Moscou, 8vo. Moscow, 1831.—*G. F. von Wedekind*, Ueber die Cholera im Allgemeinem und die Asiatische Cholera insbesondere, 12mo. Frankfort am Main, 1831.—*C. F. Harless*, Die Indische Cholera nach allen ihren Beziehungen, geschichtlich, pathologisch-diagnostisch, therapeutisch und als Gegenstand der Staats und Sanitäts-Polizei dargestellt, 8vo. Braunschweig, 1831.—*M. G. Weyland*, Traité sur le Choléra Asiatique, &c., 8vo. Paris, 1831.—Edinburgh Medical and Surgical Journal for April, July, and October, 1831.—*W. Macmichael*, Is the Cholera Spasmodica of India a contagious Disease? 8vo. London, 1831.—*J. S. Borchardt*, Kurze Darstellung der Cholera, 8vo. Ber., 1831.—*J. Lizars*, Substance of the Investigations regarding Cholera Asphyxia, 8vo. Edinburgh, 1832.—*J. Copland*, Of Pestilential Cholera, its Nature, Prevention, and Curative Treatment, &c., 12mo. Lond., 1832; and Foreign Quarterly Review, art. *Pestilential Cholera*, Oct., 1831.—*D. M. Moir*, Practical Observat. on Malignant Cholera, as that Disease is now exhibiting itself in Scotland, 2d ed., 8vo. Edinburgh, 1832.—*T. Molison*, Remarks on the Epidemic Disease called Cholera, as it occurred in Newcastle, 8vo. Edinburgh, 1832.—*T. Thackrah*, Cholera, its Character and Treatment, with reference to the Disease as now existent at Newcastle, 8vo. Leeds, 1832.—*W. Haslewood* and *W. Moody*, History and Medical Treatment of Cholera, as it appeared at Sunderland, 1831, with Cases and Dissections, 8vo. Lond., 1832.—*W. B. O'Shaughnessy*, Report on the Chemical Pathology of the Malignant Cholera, containing Analyses of the Blood, Dejections, &c., of Patients labouring under that Disease, 8vo. Lond., 1832.—*F. W. Becker*, Letters on the Cholera in Prussia, 8vo. London, 1832.—*T. M. Greenhow*, Cholera, as it appeared in the Towns of Newcastle and Gateshead, with Cases illustrative of its Pathology, &c., 8vo. Lond., 1832.—*W. Ainsworth*, Observations on the Pestilential Cholera, as it appeared at Sunderland in 1831, and the measures taken for its Prevention and Cure, 8vo. Lond., 1832.—*W. R. Clanny*, Hyperanthraxis, or the Cholera of Sunderland, 8vo. Lond., 1832.—*F. Cobb*, Report, &c., on the Subject of the Epidemic Cholera now prevailing at Newcastle and its Neighbourhood, 8vo. Lond., 1832.—*W. Fergusson*, Letters upon Cholera Morbus, with Observat. on Contagion, Quarantine, &c., 8vo. Lond., 1832.—*W. H. C. Gray*, Dysenteria Serosa, or Convulsive Nervous Cholera of Hindostan: its Progress from Asia, 1817, to England in 1831, and its Remedy, 8vo. London, 1832.—*J. Webster*, On Epidemic Cholera, its contagious Character, Treatment, &c., 12mo. Lond., 1832.—*W. Russell* and *D. Barry*, Official Reports made to Government on the Disease called Cholera Spasmodica, as observed by them in their Mission to Russia in 1831, &c., 8vo. Lond., 1832.—*Tacheron*, De la Mortalité du Choléra Morbus dans le xi Arrondissement de Paris, &c., 8vo. Paris, 1833.—*P. Voisin*, Mém. sur le Choléra Morbus à l'Hôpital St. Louis, 8vo. Paris, 1833.—*Briere de Boismont*, Des Premiers Secours à donner aux Personnes atteintes du Cholera, 8vo. Paris, 1832; et Relat. Historique et Médicale du Choléra Morbus de Pologne, 8vo. Paris, 1832.—*J. Bouillaud*, Traité Pratique, Théorique et Statisque du Choléra Morbus de Paris, 8vo. Paris, 1832.—*L. C. Roche*, Mem. sur le Cholera Morbus épidémique observé à Paris, 8vo. Paris, 1832.—*A. V. Gendrin*, Monog. du Choléra Morbus Epidémique de Paris, 8vo. Paris, 1832.—*J. Delpech*, Etudes de Choléra Morbus en Angleterre et en Ecosse, 8vo. Paris, 1832.—*Martyn Paine*, Letters on

the Cholera Asphyxia in New-York, 8vo. New-York, 1833. —*A. Smith*, The Cholera Spasmodica as observed in Paris, 1832, 8vo. New-York, 1833.—*Beaumont*, Mém. sur la Formation et la Contagion apparente des Atmosphères Cholériques, 8vo. Paris, 1833.—*W. Leigh*, Narrative of the Cholera at Bilston, 8vo. Wolverhamp., 1833.—*D. B. Bullen*, Pract. Observat. on the Epidemic Cholera at Cork, 8vo. Lond., 1832.—*Brown*, in Cyclop. of Practical Medicine, vol. i., 1832.—*F. Corbyn*, Treatise on the Epidemic Cholera in India, 8vo. Calcutta, 1832.—*J. W. Francis*, Letter on the Cholera Asphyxia of New-York, 8vo. New-York, 1832.—*J. Hamet*, Official Reports on the Cholera at Dantzich, 8vo. Lond., 1832.—*J. Keir*, A Treatise on the Cholera of Moscow, in 1830, 1831, 8vo. Edinburgh, 1832. —*J. M. S. Kennedy*, A Lecture on the Cholera at Ashby-de-la-Zouch, 8vo. Ashby, 1832.—*H. M'Cormac*, Observations on the Spasmodic Cholera, &c., 8vo. Belfast. 1832.—*D. M. Moir*, Proofs of the Contagious Nature of Malignant Cholera, 8vo. Edinburgh, 1832.—*H. Gaulter*, The Origin and Progress of the Cholera at Manchester, 8vo. London, 1833.—*J. P. Needham*, Facts and Observations on the Cholera in York, 8vo. London, 1833.—*W. Twining*, A Practical Account of Epidemic Cholera, 8vo. Lond., 1833.—*R. Cranfield*, Pract. Observations on Cholera, and on the Treatment of the Disease, 8vo. Dublin, 1834. —*J. B. Kell*, On the Appearance of the Cholera at Sunderland in 1831, with some Account of that Disease, 8vo. Edinburgh, 1834.—*J. Parkin*, Mém. sur le Traitement Curatif de Choléra Epidemique, 8vo. Mont., 1835; Rapport sur le Choléra dans Paris et le Departement de la Seine, in 1832, 4to. Paris, 1834.—*C. Y. Haines*, Practical Remarks on the Treatment of Malignant Cholera, 8vo. Cork, 1838.—*Griffin*, in Med. Gazette, April 14, 1838, p. 113.— *Bellingeri*, in Brit. and Foreign Med. Review, Jan., 1838, p. 234; Med. and Chirurg. Review, Jan., 1838, p. 164.— *G. Budd*, In Library of Pract. Med., vol. iv., p. 103.—*W. Merriman*, in Trans. of Med. and Chirurg. Society, vol. xxvii., p. 405.

[Am. Bib. and Refer.—Essays on Pathology and Therapeutics, being the Substance of the Course of Lectures delivered by *Saml. Henry Dickson*, M.D., Prof. of the Inst. and Pract. of Med. in the Medical College of the State of South Carolina, 2 vols., 8vo, p. 588–651. Charleston, 1845. —A Treatise on the Practice of Medicine, by *George B. Wood*, M.D., Prof. of Mat. Med. and Pharmacy in the University of Pennsylvania, 2 vols., 8vo. Philadelphia, 1847.— *Moore Hait*, in Bost. Med. and Surg. Journ., vol. vi., p. 59.— *Joseph Comstock*, *Ibid.*, p. 269, and vol. vii., p. 149.—*N. P. Willis*, Account of Cholera in Paris, *Ibid.*, p. 279, 302.— Mass. Report on Cholera, by Drs. *Warren*, *Shurtleff*, *Shattuck*, *Hayward*, and *Randall*, *Ibid.*, p. 320.—Cholera in Canada, *Ibid.*, p. 340.—Report of Drs. *Bigelow*, *Ware*, and *Flint*, a Boston Committee to visit New-York, and investigate the Nature and Treatment of Cholera, *Ibid.*, p. 353.— *J. A. Allen*, in *Ibid.*, p. 367, and vol. vii., p. 165, 213.— *Thomas Miner*, On Cholera, in *Ibid.*, p. 395, and 375, et vol. vii., p. 21, 44, 63.—*Henry Bronson*, in *Ibid.*, Account of Cholera at Albany, p. 379.—*John Ware*, Account of Cholera in New-York, in *Ibid.*, p. 411.—History and Progress of Cholera in New-York City, *Ibid.*, p. 353, 369, 386, 402, et vol. vii.—*James Morgan*, in Boston Med. and Surg. Jour., vol. vii., p. 14.—*Charles A. Lee*, in *Ibid.*, p. 17.—*W. Turner*, Account of Cholera at Newport, *Ibid.*, p. 26.— *Martyn Paine*, in *Ibid.*, p. 35, 74, 95, 196, and Letters to *J. C. Warrin*, on Cholera Asphyxia, as it nppeared in the City of New-York, 8vo, p. 160. New-York, 1832.—An Account of the Progress of Cholera in the United States. *See* Bost. Med. and Surg. J., vols. vi., vii., viii., ix., x., xi., xii., xiii.—*C. Jewitt*, in *Ibid.*, vol. vii., p. 64.—*E. G. Davis*, On Saline Injections in Cholera, *Ibid.*, p. 222.—*E. M. H. Ellis*, On Cholera, in *Ibid.*, p. 349.—*J. C. Howard*, in *Ibid*, p. 282, 351.— *B. James*, in *Ibid.*, p. 160.— *L. W. Sherman*, *Ibid.*, p. 331.—*J. E. Stevenson*, *Ibid.*, p. 181.—*A. F. Holmes*, History of Cholera in Montreal, *Ibid.*, vol. viii., p. 53.—*C. Hooker*, in *Ibid.*, p. 378.—*B. F. Rose*, *Ibid.*, p. 119.—*T. S. Savage*, *Ibid.*, p. 202.—Facts and Observations upon Spasmodic Cholera, addressed by the Board of Health to the Inhabitants of the City of Quebec, &c. Quebec, 1832.—Information for the People on Cholera, including a Sketch of its History, Symptoms, Preventives, and Treatment. Philadelphia, 1832.—*C. R. Gilman*, Hints to the People on the Prevention and Early Treatment of Spasmodic Cholera. New-York, 1832.—Remarks on the Cholera, embracing Facts and Observations collected at New-York during a visit to the city expressly for that purpose. Providence, 1832.—Report of the Committee of the Kappa Lambda Society, appointed for the purpose of preparing an account of the mode of Treatment of Epidemic Cholera, June, together with an additional Report, presented Aug. 15, 1832. New-York, 1832.—*Ashbel Smith*, The Cholera Spasmodica, as observed in Paris in 1832, comprising its Symptoms, Pathology, and Treatment, illustrated by Cases. New-York, 1832.—*Edward Warrin*, Sketch of the Progress of the Malignant or Epidemic Cholera, from its arrival in America, with Tables illustrative of its Progress in the principal Cities it has visited. Boston, 1832.—*A. Brigham*, M.D., A Treatise on Epidemic Cholera, including a Historical Account of its Origin and Progress to the present Period. Compiled from the most authentic Sources. Hartford, Conn., p. 368, 1832.—*Elisha North*, On Cholera, in Boston Med. and Surg. Jour., vol. vii., p. 197.—*Daniel Eastman*, in *Ibid.*, Reports of Hospital Physicians, and other Documents in relation to the Epidemic Cholera of 1832. Edited by *Dudley Atkens*, M.D. New-York, 1832, 8vo, p. 200.— *G. R. B. Horner*, Account of the Cholera which occurred on board the U. S. Ship John Adams (Am. Journ. Med. Sci., vol. x., p. 257).—*Joseph M. Smith*, A Discourse on the Epidemic Cholera Morbus of Europe and Asia, &c., 1831.—*C. W. Pennock* and *W. W. Gerhard*, Observations on the Cholera of Paris, Am. Jour. Med. Sci., vol. x., p. 319, 521.—*Paul M. Eve.* in *Ibid.*, p. 524.—*J. P. Hopkinson*, in *Ibid.*, 533.—*C. A. Lee*, On Cholera, in *Ibid.*, 544, and vol. xv., p. 256.—*James Jackson, Jr.*, Cases of Cholera, collected at Paris, at the Hospital la Pitié. Boston, 1832, 8vo, p. 212.—*L. Munsell*, in Am. Jour. Med. Sci., vol. ii., p. 251. —*J. C. Skinner*, in *Ibid.*, p. 252.—*W. Channing*, On the Camphor Treatment of Cholera, in *Ibid.*, p. 254.—*H. W. Baxley*, in *Ibid.*, p. 257.—*James M'Naughton*, Letter on Epidemic Cholera of Albany, addressed to *Thomas Spencer*, M.D., in *Ibid.*, p. 260.—*Chas. T. Jackson*, in *Ibid.*, p. 266.—*Samuel Jackson*, in *Ibid.*, vol. xi., p. 275; vol. xii., p. 76.—*J. B. Zabriskie*, On Cholera, in *Ibid.*, p. 355.— *Henry Bronson*, Observations on the Chlorides and Chlorine, as "Disinfecting Agents," and as preventives of Cholera. Boston, 1832, p. 12, 8vo.—*H. Chapman*, Lecture on Cholera Morbus, in Am. Jour. Med. Sci., vol. xii., p. 281.— *Hunting Sherrill*, On Epidemic Cholera, as it prevailed in Dutchess County, New-York, 8vo, 1832, p. 38.—*Hugh L. Hodge*, On Cholera, in *Ibid.*, p. 386.—*James Cauper*, in *Ibid.*, p. 261 —*John S. Brown*, Observations on the Original Causes of Malignant Cholera, *C. S. Francis*, New-York, 1835, p. 41.—*W. E. Horner*, On the Anatomical Characters of Asiatic Cholera, with Remarks on the Structure of the Mucous Coat of the Alimentary Canal, in Am. Journ Med. Sci., vol. xvi., p. 58, 277.—*Robley Dunglison*, The Practice of Medicine, A Treatise on Special Pathology and Therapeutics, &c., 2 vols., 8vo. Philadelphia, 1844.— *Thomas Spencer*, An Address on Diarrhœa Serosa (Cholera), before the New-York State Med. Society.]

PESTILENCE, HÆMAGASTRIC.—Synon. *Pestilentia hæmagastrica* (from *αἷμα*, *blood*, and *γαστὴρ*, *the belly*), Author. *Typhus icterodes*, Sauvages, Cullen. *Febris flava*, Auct. Var. *Synochus icterodes*, Young. *Causus*, Moseley. *Febris flava Americanorum*, I. Frank. *Epanetus malignus flavus*, Good. *Fièvre Jaune*, *Typhus Jaune*, *Fièvre Matelotte*, *Mal de Siam*, Fr. *Gelbes Fieber*, *Schwartes erbrechen*, *Westindisches fieber*, Germ. *Fiebre gialla*, Ital. *Fiebre Amarilla*, *Vomito negro*, *Vomito pricto*, Span. *Hæmagastric Fever*, or *Pestilence*, Author. *Yellow Fever*, *Black Vomit*, *Malignant Yellow Fever*, *Pestilential* or *Bulam Fever*, *Epidemic Yellow Fever*.

1. Defin.—*After chills* [*or rigours*], *shivering, and languor, severe pain in the orbits and forehead, also in the* [*back*], *loins, and limbs; rapid pulse, flushed face; glassy, suffused eyes; peculiar burning heat of skin, and frequently delirium; nausea and vomiting, with epigastric pain, costiveness, great anxiety, restlessness, and watchfulness; subsequently hiccough, black vomiting, scanty or suppressed urine, hæmorrhages from the mucous canals, lemon or muddy yellowness of skin, generally terminating in death in its most severe form.*

2. Pathological Characters.—*An infectious miasm or animal poison, specifically affecting the organic nervous and vascular systems and the vitality of the structures; impairing the crasis and constitution of the blood and the vital cohesion of the tissues; and more especially implicating the stomach and digestive mucous surface, and leaving the frame protected from a second attack, if recovery take place.*

3. The origin, nature, and treatment of this pestilence have attracted the attention of the medical profession, and even of governments, in a remarkable manner for many years. The

ravages of it, during 1793 and 1794, in the West Indies and the United States, and the subsequent recurrences of these ravages both in America and in Spain, have furnished most important subjects for investigation, and have engaged the abilities of several eminent physicians, both in this and in foreign countries. Notwithstanding the volumes of descriptions and of controversy which have resulted, opinions are still unsettled respecting the source and true nature of the disease. It may be reasonably inquired, what are the causes which have so long retarded our knowledge of so important a subject? These, it may be presumed, are in many respects the same as those which usually stand in the way of our advancement in every other department of human science. The subject presents also difficulties which are peculiar to itself; and not a few sources of error are attributable to many of the writers who have attempted to furnish information respecting it, or to enter the lists of controversy. There are, perhaps, but few of the numerous disputants on either side of the question who can at the present day be quoted as authorities, deserving in every respect implicit confidence. The majority of them entered upon the inquiry —if, indeed, due inquiry or research were ever attempted—with judgments previously biased. Others possessed neither that amount of scientific education, nor that tutored state of intellect, which are requisite to medical observation in all circumstances, and particularly in those connected with investigations into pestilential visitations. Where it was most necessary that the relations subsisting between the geological formations, the soil, the locality, the climate, and the meteorological vicissitudes of a country, and the states of the brute, as well as the human inhabitants, should be comprehensively yet accurately observed, in respect of their healthy condition, of prevailing diseases, and of epidemic visitations, many of the elements requisite to the formation of sound views have either been overlooked, or purposely exaggerated, or even misrepresented: some have drawn sweeping conclusions from narrow fields of observation; and many have erred, more or less, in considering this pestilence in too close connexion with those maladies which have existed previously or appeared subsequently to its prevalence. The importance of ascertaining differences, as well as of marking points of similarity, upon which specific differences, or identity of nature, may be based, has been overlooked; and much too frequently a few features of similarity have been seized, and identity of character has been thence assumed, without duly estimating the numerous differences associating themselves with each of these features. It must not, however, be forgotten that occasionally there appeared in the arena individuals whose opinions will always obtain respect, and who added to their scientific and medical reputation by the discussion, and who evinced, by an honourable spirit and temperate zeal, that truth was the sole object of their inquiries.

4. In thus regretting that the visitations of this pestilential fever—which I have above denominated, from its prominent pathological characters, Hæmagastric Pestilence or Fever —have not always been observed, during their rise, progress, and decline, by persons altogether qualified for the undertaking; and that the subject has been viewed as seldom from the "elevated table-land of human science," as with minds entirely divested of prejudice or preconceived opinions; it must also be admitted that the amount of scientific acquirement actually brought to the task of investigation has often tended more to entangle than to elicit the truth. The little that is known, or rather our want of knowledge, of the nature of malaria, of the constituents of emanations from the soil, and of other imputed sources of pestilential diseases—the mist of ignorance and of prejudice involving these agents and exaggerating their influence — their inferred operation, without further proof of their existence than certain effects which have been imputed to them, either upon insufficient data, or even without the smallest evidence—combined to mislead those who generally repose on the authority of others, and to prevent those salutary measures of prevention being undertaken which can be based only upon sound views of the source and nature of pestilence. The undue weight of insufficient or false authority, the array of imperfectly observed phenomena and "false facts," and the prevalence of hastily preconceived opinions, of false theory, and of premature generalization, have swayed the minds of many from obvious truths and natural conclusions into errors of the most deplorable kind, and plunged not merely towns and districts, but populous cities and kingdoms, into the deepest abyss of misery. Concentrated marsh or terrestrial exhalations, according to many of those who most plumed themselves on their science and philosophy, produced plague in Egypt and other parts of the Mediterranean coasts, gave origin to yellow fever in the West Indies, the United States, and in Spain, and was the only cause of pestilential cholera over the globe. The influence of this cause, and its power to produce all these and many other effects, were as firmly believed in by them, and with less, certainly with no greater reason, than Tertullian believed in the power of the devil to produce similar distempers: "Inducere potest morbos et sanitates. Viscerum actiones potest inhibere latenter, et venenis nobis ignotis corpus inficere." And what have been the results? The history of pestilential yellow fever on both sides of the Atlantic during little more than half a century is the reply—a history the more humiliating to medical science, and to human nature, the more intimately it is investigated. Whether a belief in the influence of terrestrial exhalations, as presumed by the pseudo-lights of medical knowledge, or confidence in the power so dreaded by Tertullian and some other fathers of the Church, actuated those whom circumstances unworthily and most unhappily clothed with authority on many important occasions, is not material as respects the results; for, as either belief must necessarily have led to similar consequences, and as neither agency could be controlled by available means of prevention or counteraction, so they were left to their own course, and thus gave rise to effects of the most deplorable kind. If the simple truth had been seen, and the dictates of common sense been followed, measures calculated to prevent the extension of pestilence at its earliest appearance would have been taken, and success-

fully carried out on many occasions; but, unhappily, truth and common sense are as seldom the basis of theory, as they are the incentives of human actions. The simple fact that certain distempers were communicated from one person to several, from a few to many, might have been viewed as sufficiently intelligible, and considered as sufficient grounds for a disregard of all opposing views which had no other basis than vague hypothesis, certainly none stronger than that confided in by TERTULLIAN, and have led to attempts at isolating the affected, and thereby protecting the healthy. But, before proceeding to the discussion of the topics to which this train of ideas would lead, and which will more appropriately be considered in the sequel, I must *first describe* the pestilence now under consideration.

5. I. DESCRIPTION.—*Hæmagastric or continued yellow fever* resembles scarlet fever in some respects, and more especially in the several degrees of malignity and the modifications it presents, in different individuals, during the same epidemic. Generally, the higher the grade of atmospheric temperature in which it occurs, the more stagnant the air, the closer the situations and the apartments, the greater has been the prevalence and the mortality of the pestilence. It manifests, also, a greater perdilection for some constitutions than for others, attacking some in a very mild, and others in a very malignant form. Sir W. PYM states that this peculiarity was very remarkable at Gibraltar in 1804, where, in some instances, whole families fell victims to it, while others, equally numerous, under the same treatment, escaped with a slight attack. The same was remarked at Seville, Cadiz, and other places, and in other epidemics. The states of constitution and temperament giving rise to this predilection are not so manifest as to permit anything being stated with precision respecting them. Owing, however, to temperament, sex, age, and constitution, in some measure, and to other *predisposing* and *concurring causes* hereafter to be mentioned, this distemper presents certain *grades* or *modifications*.

6. i. The *mildest form* of hæmagastric pestilence is most frequently observed in children, and, during some epidemics, in females, although occasionally females have suffered most severely. It generally makes its appearance with languor and slight chills, soon followed by heat of skin; quick and full pulse; uneasiness in the loins and limbs; severe headache, confined chiefly to the orbits and forehead; a peculiar shining or drunken appearance of the eyes; hot, dry skin; a loaded but moist tongue, with little thirst; sickness at stomach, with costiveness, and a feeling of uneasiness, not amounting to pain, at the epigastrium, and a sense of rawness or soreness in the fauces and in the course of the œsophagus. These symptoms may continue from twelve to twenty-four or thirty-six hours, when the patient, having taken only some purgative and febrifuge medicines, or an emetic, falls into a refreshing sleep, from which he awakes in a gentle perspiration, free from pain and fever, and complaining of debility, from which he rapidly recovers.

7. ii. The *more severe* and more frequent form appears more suddenly, and the symptoms are much more violent. The attack is ushered in by shivering and rigours. The pain in the orbits and forehead is excruciating; severe pain is also complained of in the loins and calves of the legs; the face is flushed; the eyes are glassy, suffused, or apparently inflamed; the pulse is rapid; the skin burning hot and dry; and the tongue is loaded, but moist, with little thirst. A few hours afterward uneasiness of stomach, with nausea and vomiting, supervenes; followed by severe pain and tenderness at the epigastrium, with a sense of rawness, heat, or inflammation in the fauces and down the œsophagus; great anxiety, restlessness, and watching, with a desire of sleep. The bowels are constipated, the evacuations scanty and deficient in bile; the urine dark-coloured, and small in quantity.

8. If the disease be judiciously treated, these symptoms often become ameliorated on the second or third day, the patient falling into a sleep, from which he awakes refreshed, with a perspiring or moist skin, and nearly free from all the symptoms. Debility only remains, the recovery from which is generally rapid. In many cases, however, either a partial amelioration only occurs, or the more complete subsidence of the symptoms is of short duration, the patient in a few hours beginning to be troubled with flatus in the stomach, and distressing hiccough. Not unfrequently the patient is suddenly and unexpectedly seized with faintness, sickness, and painful retchings, followed by vomiting, at first of whatever had been taken into the stomach, but soon afterward of a brownish fluid, resembling dirty water, mixed with a dark-coloured, flaky matter, which floats upon its surface; and at last by a matter resembling coffee grounds or thin pitch. At this time, also, a great change takes place in the countenance, which assumes a putrid, dingy, and bloated appearance, which is most remarkable in those of a florid or sanguine complexion. A light yellow or lemon tinge appears under the eyes and ears, and soon spreads down the neck to the chest, and over the whole body. The vessels of the conjunctiva appear relaxed, and distended with blood. The vomitings continue, and the quantity of fluid ejected much exceeds that which has been drunk. They often return without being excited by ingesta; or even suddenly or unexpectedly, and when the patient has just before considered himself relieved from them. In the latter hours of the disease, they are attended by a peculiar loud and hollow noise, which is heard at a considerable distance. During this state the patient is generally sensible to surrounding objects, and aware of his fate. He is restless, continually tossing about in his bed, with an expression of despondency in his countenance. He looks anxiously and inquiringly around for relief, but unable to express all his misery and his wants. At last, worn out with restlessness and fatigue, he sinks without a struggle.

9. iii. The *third form* of attack also commences with shivering or rigours, and is an aggravation of the symptoms of the second from the beginning. In this form the face is more flushed, and the burning heat of skin is greater than in the preceding. The sickness at stomach, hiccough, and black vomiting appear much

earlier. The bowels are obstinately constipated, and resist strong purgatives; the motions being watery, of a dirty colour, and rarely feculent or bilious. Violent delirium often occurs early in the attack, and hæmorrhages frequently take place at an early period from the nose, mouth, eyes, ears, and even from all the outlets of mucous canals. The tongue is often clean, moist, livid, or red, and raw-like, or covered with dissolved blood. The action of the kidneys is suppressed, either little or no urine being secreted. The countenance changes to a livid and yellowish hue, with yellowness of the skin. In the most severe of these attacks the patients may be carried off on the second, but generally on the third day, sometimes in convulsions.

10. In plethoric persons and in the sanguine temperament the attack is often most violent; and in addition to the symptoms just mentioned, the countenance appears bloated and heavy, with an unnatural expression, or wild and agitated. The heat of the surface, which was at first great and pungent, falls first in the extremities, and afterward over the whole body, especially after the occurrence of black vomiting; and ultimately it sinks below the natural standard. The skin becomes compacted, losing its vascularity, and is insensible to the irritation of blisters. It is rarely dotted with petechiæ, but much oftener streaked with yellowish lines, particularly in the course of large blood-vessels, or is covered by patches of a bluish or leaden colour, especially in flaccid parts. The sense of internal distress increases as the febrile action subsides. Distention of the hypochondria, and explosions of flatus from the stomach, are frequent, with occasional obscure hiccoughings. Sometimes the vomitings are hardly complained of until the more febrile symptoms begin to abate, when they become unrestrainable: the matters ejected are then muddy or turbid, like unstrained coffee; occasionally they are of inky blackness, like the juice of the cuttle-fish. The evacuations by stool sometimes also present a black appearance at this stage. In the more severe states the disease frequently terminates fatally within the fifth day. In the less severe cases signs of an imperfect crisis sometimes appear about the seventh day, and improve to favourable indications, but occasionally they are arrested in their course, and superseded by an unfavourable train of symptoms, as hæmorrhages from the throat, gums, mouth, and sometimes from other outlets of mucous canals. The blood is dissolved, dark, incoagulable or grumous, particularly at a far-advanced period of the disease.

11. iv. The *fourth form* of the pestilence seems a modification of the symptoms by temperament and habit of body, although the precise conditions of these cannot always be assigned, the phlegmatic, apparently, most frequently exhibiting it. In this the symptoms are not so violent as in the third form, but they are equally fatal. It often commences insidiously, the patient complaining for hours, or even longer, of nothing but languor or fatigue, which is followed by chilliness or rigour, with pains in the loins and calves of the legs. The headache is not very severe. The pulse is quick and small. The heat of skin is very little increased; but there are great anxiety and oppression at the præcordia, and an indifference to surrounding objects. The bowels are obstinately confined, and the secretion of urine is arrested. The tongue is often unnaturally clean, and of a clear, shining, vermilion colour. Hæmorrhage appears early from the nose, gums, or mouth, and is sometimes attended by petechiæ and vibices. There is little or no thirst, but great irritability of stomach, with hiccough and black vomiting, attended sometimes, as the distemper proceeds, especially towards the fatal close, by an involuntary discharge of the same appearance from the bowels. The peculiar change of countenance, with yellow skin, takes place as in the other states, and is frequently accompanied with a low muttering delirium. The temperature of the surface generally falls below the natural standard as the disease advances. Distress at stomach and intolerance of pressure over this region are generally present. The bowels are almost insensible to the action of purgatives, which either produce no effect or only watery evacuations—sometimes cold, ropy, and black, as if mixed with powdered charcoal. As the distemper advances, the pulse sinks in frequency, becoming weak and small. In some instances it sinks below the natural frequency, and becomes irregular or intermittent. Death in this, as well as in the preceding state, may occur as early as the second day, especially when the brain is the prominent seat of morbid action; but it more frequently occurs on the third or fourth day, or not until the fifth, sixth, or seventh. A favourable change is remarked chiefly on the third, fifth, or seventh day.

12. v. The above are the chief states of the distemper commonly observed, modified, however, or the one passing into the other, according as constitution, concentration of the cause, and varying concurring circumstances aggravate the seizure. Certain anomalies may, however, occur; but modifications in the type are not observed. They are, however, noticed by some writers, and others, as Dr. Jackson, have described a form in which the symptoms are at first remittent, but become continued in the course of the malady. When treating of the more severe states of remittent fevers, especially as they occur within the tropics, and beyond the tropics in localities and seasons favouring the development of the more intense or malignant forms of remittent fever, I have shown, that the passage of that type into the continued is extremely frequent, especially when vital organs become more and more implicated, and when the disease increases in prevalence, so as to assume an epidemic character, the fever, with this change of type, generally also presenting in the worst cases the chief features of the true hæmagastric pestilence, particularly yellow skin, and in rare cases even black grumous vomiting. (*See art.* Fever, Remittent, § 233, *et seq.*) These facts are admitted by the non-infectionists, and are indisputable. But it is not proved, that, with this change of type, and with the supervention of these features, the fever, which certainly was non-infectious as long as it was remittent, becomes infectious as soon as it becomes continued, unless a number of affected persons are so circumstanced, especially from crowding and

imperfect ventilation, during very warm and humid states of the air, as to contaminate the surrounding atmosphere; and thereby either to superadd the additional cause of a morbid effluvium exhaled from the sick to existing marsh miasmata, or to generate a morbid poison or vapour, which is of itself capable, independently of marshy or other miasmata, of infecting the healthy, and of disseminating the distemper. It is almost impossible on some occasions, and certainly difficult in all, to ascertain, beyond the reach of controversy, whether the one contingency or the other obtains; still, the observing physician will generally arrive at just conclusions on the subject, and act in such a manner as the great responsibilities reposed on him will justify.

13. That a superadded property, or at least a change of character, should result from the circumstances just alluded to, may be rationally inferred; for the aggravation of symptoms and the development of new features, in these altered circumstances, have frequently been observed, are undoubted, and are the chief sources of much of the differences of opinion, and of the discussions which have appeared since the end of the last century on the subject of yellow fever; for, owing to them, and to causes sufficiently noticed above (§ 12), these aggravated states of remittent fever, either passing into, or originally assuming more or less of a continued form, have been confounded with the true or infectious yellow fever—with the pestilence now under consideration. The circumstances, moreover, of the latter being developed only during those high ranges of temperature, and in those situations which render remittents thus malignant and prevalent, has increased the difficulty of distinguishing the one from the other, and has led several writers, who have observed the simultaneous prevalence of both maladies in the same locality—a circumstance by no means infrequent in the West Indies and in some other countries—to describe both as varieties merely of one distemper, and to ascribe the properties possessed only by the one to the other also. As much ambiguity has arisen from this source, I will notice more particularly than can be done when treating of the *diagnosis* of this pestilence, certain symptoms which require attention, as well as others which are only occasionally remarked. Such diversities or modifications of character evidently result from diversity of the predisposing and concurring causes, from the concentration of the infectious agent, or the dose of the animal poison conveyed in the atmosphere, and from the idiosyncrasy or constitution of the infected.

14. *Suddenness of attack* is one of the prominent characters of the malady; there seldom appearing any premonitory ailment, at least of such severity as to attract particular notice. In some cases, however, a feeling of fatigue or lassitude, with headache and costiveness, are complained of for a short time previously. *The pains* felt in the head, loins, limbs, and often, also, in the large joints, generally precede or accompany the chills, shiverings, or rigours attending the seizure; and these are often very severe, but they appear to change their character, without being less distressing, as reaction takes place. *The seizure* usually occurs in the night or morning, but there are numerous exceptions to this period. The *pulse*, during the cold or incipient stage, varies. It is small, frequent, and irregular during the incipient state of chilliness or rigour, during which the temperature of the skin over the trunk is generally increased, although it is much lower in the extremities. The pulse becomes more frequent, sometimes very quick, as reaction is developed, but it is also broad, open, soft, or very compressible. As collapse supervenes, it is soft, weak, or irregular, ultimately becoming small, feeble, or suppressed. The pulse, however, in this stage of exhaustion varies much in different cases, owing to the loss of a considerable portion of the serum and hæmatosine of the blood by vomiting, and according to the amount of such loss, as well as to the impaired irritability of the heart. The *tongue* varies in its character as the disease advances, and often, also, at the commencement, as well as at the close of the distemper, it presents different appearances in different cases. It is frequently, at first, furred or loaded in the middle or root, but moist and red, or inflamed, at the point and edges. It is in some moist, red, purplish, and clean; in others it presents a dry streak in the middle, and in many, and those the most unfavourable, it is of a vermilion red or purplish red colour, covered in a few instances with an exudation of fluid blood, either at an early or at an advanced stage, according to the violence and danger of the attack. It often has a raw appearance, and is more or less swollen or flabby.

15. The *countenance* varies in appearance and expression with the progress of the distemper, and the age, habit of body, and temperament of the patient. At the commencement of the seizure, the face is usually pale, and the features somewhat sunk; but as soon as the chills and rigours cease it becomes full, flushed, and turgid; the lips tumid and red; and the eyes protruded, prominent, bright, and inflamed, with exquisite pain at the bottom of the orbits, and in the forehead. As the disease advances, the countenance assumes a peculiar *pale lemon colour*, which, in the most unfavourable cases, passes into a *livid*, *muddy*, or *putrid appearance*, which has been aptly likened by Sir W. Pym to that presented by the face in the childish diversion of snap-dragon. In thin, emaciated, and aged persons the features become sunk, especially as the disease advances; but in others, unless when the quantity of dark fluid thrown off the stomach is very great, the face continues tumid to the last, particularly when the fatal progress of the malady is rapid. A sense of constriction is often felt in the *chest*, and anxiety at the præcordia; and towards the close there is a continued movement of the hand over the præcordia and chest. The *breathing* is often laboured, occasionally deep or suspirous, with a peculiar groaning or moaning; and the voice is frequently altered. A burning heat is usually felt at the epigastrium, and not infrequently in the course of the œsophagus. Everything is rejected from the stomach, and the patient tosses his head and limbs about. *Stools* are always procured with great difficulty early in the distemper, and while reaction continues; but after the deceitful calm, about to be noticed (§ 17), they often become more free, and sometimes involuntary. They are always

scanty at first, offensive, watery, and deficient in bile; but they frequently are black and watery, sometimes with small, lighter-coloured flocculi in the last stage, and when black vomit has taken place. The *urine* is at first scanty and high-coloured, and in the worst cases it is entirely suppressed, none being secreted, owing either to a paralyzed state of the kidneys, or to the quantity of serum lost by the blood, as in the pestilential cholera, by the frequent and copious discharges from the stomach. The patient generally feels severe pain in glans penis and urethra when the urine is suppressed, or passed only in a few drops. The *blood* is always more or less changed—most remarkably after the calm occurring on the third day. Even at the commencement and during reaction, it does not coagulate, or does so imperfectly and loosely, and is deficient in fibrin. It afterward becomes still more loose and defective as to crasis, and ultimately very dark, partially dissolved, and grumous; and apparently insufficient in quantity, in many cases, to distend the veins. The *perspiration* and the *evacuations* are very offensive, and have a peculiar sickly odour, which thoroughly imbues woollen and cotton clothes, and the patient's bedding.

16. The *mental manifestations* are variously affected in different persons. In some, violent delirium occurs; in others, low delirium, occasional wanderings of the mind, or waking dreams, are remarked; in many, the mind is not materially affected throughout, unless inasmuch as the patient may be despondent, taciturn, depressed, or apathetic. An early conviction of a fatal issue, indifference to the result, and a calm apathetic resignation to his fate, are frequently observed without any farther mental disturbance, the patient's intellects continuing unimpaired to the last. In some, the violent delirium present during an early period disappears, and the mind afterward remains calm until death.

17. Slight *exacerbations* are sometimes remarked in the evening, and ameliorations in the morning; but these are rarely so considerable as to amount to remissions, the disease generally pursuing a continued course until the third or early in the fourth day, when a deceitful *calm* appears. The pulse then often falls to nearly its natural frequency, sometimes even below it; the eyes lose their brilliancy. The heat of skin also sinks, especially in the extremities, when it often falls below the natural standard. This calm usually continues all the fourth day, and the patient, feeling some returning craving for food, thinks himself convalescent;- but lemon-yellowish of the skin, sometimes delirium, mental depression or apathy, faintness upon being raised up, or upon being placed on the night-stool, vomitings, and hiccough often appear about the following evening or night; sinking of the pulse and temperature, especially in the extremities, black vomiting, suppression of urine, and other fatal symptoms, supervening more or less rapidly. In many cases the heat of surface sinks remarkably, and the extremities assume a livid appearance, the pulse being hardly felt in the limbs.

18. In the above description of this malady I have followed my own observation and recollection, aided by notes taken during my attendance upon cases which came before me within the tropics. Some of these cases occurred in a vessel in which I was a passenger, and in circumstances which strongly favoured a belief in an infectious source, as will hereafter be alluded to. The numerous descriptions of the disease which I have perused vary somewhat, especially in certain subordinate particulars, most probably owing to the varying features of the distemper in several epidemics, and in different climates, localities, and constitutions. The chief difference, however, consists in the severity of attack, and the intensity of affection evinced by the blood and digestive organs. The most dangerous cases are not those in which the symptoms are most violent, in respect of vascular or nervous excitement; but those in which the vital powers are most depressed, the blood most changed, and the black vomit most early, copious, and frequent. (*See* § 9–11.) The differences between these and the slightest grade (§ 6) are very great; the degree of fatality of the disease in America, West Indies, Spain, or Africa, depending upon circumstances about to be mentioned.

19. vi. Several of the writers on this distemper have divided it into certain *stages* or *periods*. These stages are often well marked; but in many cases they are hardly manifest. In the most violent seizures, the patient is suddenly struck, and the distemper proceeds rapidly without reaction, or nervous or vascular excitement, to vital and structural dissolution, with every indication of extreme vital depression, of vascular contamination, and of impaired or nearly-lost irritability and cohesion of the tissues. When either the powers of the constitution are sufficient to resist the overwhelming influence of the pestilential poison, or the dose of this poison is weak relatively to the state of vital resistance, then vascular reaction takes place, with or without nervous excitement, and a division of the progress of the malady into stages or periods, according to the successive changes in the states of morbid action, may be made with justice. But writers are not agreed as to the precise division which should be adopted. Some recognise merely two stages, viz, that of *excitement*, and that of *collapse* or *exhaustion*. Others contend, and with much justice, that the stage of *invasion*, or that period which is characterized by chills, rigours, or an alternation of chills and heats, and which, in a few cases, is preceded by a sense of malaise, fatigue, and headache, for a shorter or longer period, should be viewed as a distinct period. I am of this opinion, and am confirmed in it from having had an opportunity of almost constantly observing, in several cases, the phenomena during this stage, and its frequent passage into the next, or that of excitement or reaction. Other authors have considered the delusive calm ushering in the period of vital exhaustion as a distinct stage; but it rather indicates the passage of reaction into collapse, the subsequent severity of the symptoms being merely the efforts made by the vital resistance of the constitution in endeavouring to overcome the morbid changes which oppress and ultimately overwhelm it.

20. It has just been remarked that, when the infectious agent is very powerful relatively to the constitutional powers of the patient, the attack may then be so violent, and its subse-

quent course so malignant, as to deprive the vital energy of all power of reaction. In this case the *invasion* is sudden and severe, and is attended by general tremour, dread, terror, or despondency; the vital depression of this period passing into vital and even structural dissolution, with greater or less rapidity, and either with no attempts at reaction, or with weak and abortive efforts merely; the symptoms of the first period insensibly passing into those of the third. In those cases, which are much the most numerous, in which reaction or excitement occurs, and which are generally met with in the young, robust, plethoric, and in persons whose health has been previously good, the following division of the periods of the distemper, with their chief characters, may be made.

21. First Period—*or that of invasion: Charact.*—Chills, rigours, or shivering, or alternation of chills and heats; headache, with pains in the loins and limbs; fear and timidity; universal trembling; tremour of the tongue when held out, and inexpressible terror in the most severe or fatal attacks.

22. Second Period—*or that of vascular reaction and excitement: Charact.*—Very frequent, full, broad, or bounding, but soft or very compressible pulse; a loaded and pasty tongue, with redness at the edges and point; caustic heat of surface; rending or throbbing headache, with red, suffused, protruding, and brilliant eyes; pain at the epigastrium and anxiety at the præcordia; racking pains in the loins and limbs; tossings and watchfulness; general redness, turgidity, and suffusion of the face; sometimes delirium; vomitings and thirst, obstinate costiveness, and scanty, pale stools.

23. Third Period—*or that of vital exhaustion: Charact.*—Often an amelioration of the above symptoms during the third or fourth day, followed by an increased frequency of vomiting; a lemon hue of the skin, with dirty, lurid, or livid patches as this stage advances, the matters ejected becoming in some instances black; distressing singultus; low or muttering delirium, or resignation or apathy to the result, or a desire of dissolution; quick, small, feeble pulse, which is sometimes at last irregular, intermitting, or slow; raw, red, livid, moist, or dry, and clean tongue; faintness, especially on moving; loss of temperature in the surface and extremities; irregular, laborious, deep, and moaning respiration, the expired air being raw and colder than natural; scanty or suppressed secretion of urine; small, black, watery, and involuntary stools; exudations of blood from the mouth, nostrils, anus, vagina, &c.; a peculiar offensive odour from the body and evacuations; the appearance of large livid or discoloured patches, terminating in dissolution, with marked putridity, the body exhaling a tainted odour.*

24. vii. The *duration* of these stages is various. The *first* is seldom longer than a few hours; but it may be hardly of an hour's duration, or so slight as not to attract particular attention. The *second* stage varies from two to three days—it is seldom longer, and it may be even shorter than the time named. It may be, as above noticed (§ 20), altogether wanting, or imperfectly manifested. The duration of the *third* is still more indeterminate. It may be only a few hours, or it may be two or three days, or even somewhat longer, it altogether depending upon the violence of the attack and the powers of the constitution. In slight or favourable cases, this stage may not be remarked, or merely a few of the milder symptoms may only be noticed. In the most severe or fatal cases, this stage follows closely upon the first, and is attended by most of the malignant symptoms just enumerated, as early as the second or third day; and in some epidemics by others, but occasionally only. The *whole duration* of the malady varies from three to eight or nine days, but in rare instances it has been protracted to ten or twelve days.

25. viii. The *sequelæ* ascribed to the distemper by some writers deserve notice, only to observe that I do not believe in their existence. The debility consequent upon the attack cannot be justly viewed as belonging to this category, more especially as convalescence is generally rapid and complete. The visceral congestions, obstructions, and enlargements mentioned as sequelæ of yellow fever by several authors rarely or never occur after the true hæmagastric distemper, although they are frequent after severe forms of remittent fever (see Fever, § 237, *et seq.*), attended by yellowness of skin. They have been mentioned in connexion with hæmagastric pestilence, owing to the circumstance of it, and the worst cases of the seasoning fever of hot climates, and of remittent fever, having been confounded with each other by these writers. This circumstance also explains much of the imputed frequency of *relapse* in this pestilence; for the debility attending convalescence or recovery from it, renders the patient predisposed to be affected by the miasmata causing remittent fever; and hence, when hæmagastric fever prevails, as it usually does, in situations where remittent fever is endemic, and in seasons when it is most prevalent and malignant, recovery from the former malady is extremely likely to be followed by an attack of the latter; and, more than this, the one disease is very liable to be mistaken for the other.

[The symptoms of yellow fever, as it prevailed in this city in 1822, have been described with great accuracy and minuteness by Dr. P. S. Townsend, of New-York, from his own careful and repeated observations; and as they differ in some respects from those detailed with such particularity by our author, we present a brief analysis of them in this place.

The invasion of the disease was generally sudden, and at night; sometimes in the morning, and most usually like that of an ordinary fever, with, or sometimes without, chill; gaping, yawning, loss of appetite, languor, hurried respiration, faintness, nausea, and in some instances vomiting of bilious matter, or rejection of drinks and food; most usually acute pain in the head and back, and sometimes violent affection of the nervous system and severe rigours. *First stage.*—In this stage there was commonly considerable excitement, especially in full habits, and nervous or sanguine temperaments; severe pain in the head, especially the forehead, back, and loins, often extending down to the calves of the leg. The eye was usually in-

* [The peculiar offensive odour and "putridity" of which Dr. Copland speaks have not been noticed by writers on the disease in this country.]

flamed, and tinged or swollen, and often at the same time dull and suffused with tears, and a drunken appearance, the interstices between the red vessels of the adnata remaining white, and the cornea natural or uncommonly brilliant. In some cases the adnata was so crowded with blood-vessels as to appear bloodshot; after a while the eye assumed a deep greenish and dirty yellow colour; but in some instances it was almost natural in appearance. In a few instances the pupils were unusually dilated, and in others the eye was intolerant of light.

The *tongue* was generally thick and somewhat swollen, more frequently pointed than broad; most usually, in the beginning, covered with a dirty white or lead-coloured fur, darker towards the base. In some instances the tongue was besmeared with a thin, white, moist slime or paste, until towards the termination of the disease.

The *pulse* varied from 90 to 120, and in children 150; sometimes it was as low as 80, 60, and 55 from the beginning of the attack, in which cases the stage of excitement had not existed at all; it was generally full, but not strong. Where the pulse was unnaturally slow, the skin was cool from the beginning.

The *skin* was flushed, generally hot, and somewhat dry, in this stage; the degree of temperature corresponding with the force of the circulation; often *moist* throughout, and rarely, if ever, characterized by the biting, stinging heat and dry surface of typhus.

Respiration hurried, in proportion to the violence of the excitement, and almost invariably attended with deep sighing.

The *bowels* were generally constipated in this stage, but after they had been opened the evacuations continued, often natural in colour and quantity, without fetor, but rarely bilious, soft, or liquid during the whole progress of the disease.

The *stomach* was usually calm, but sometimes a constant nausea or sense of oppression at the præcordia, accompanied occasionally with eructations and cardialgia; and sometimes great gastric distress from the beginning of the attack, producing violent spasms and retraction of the abdominal vessels and legs on the slightest pressure.

Urine variable; often natural in every respect, but in many cases scanty and high coloured; in some few copious and natural.

Countenance.—Most usually natural and flushed; often a wild stare and gaze of the eye, but often entirely natural to the last.

Position and Actions of the Patient.—Invariably lies on his back, and has an inclination to throw his arms above his head.

Intellect generally undisturbed; occasional delirium, attended with coma, if the excitement was great.

Second stage.—In some cases the first stage was protracted till the fifth day, but most usually it continued from 24 to 48, or even 72 hours, at which time there came on a sudden prostration of all the animal forces, producing a state of collapse.

The *countenance* is more or less pale and shrunk, and the patient becomes calm and composed, and, though languid and debilitated, entirely free from pain.

The *blood* retires to the internal organs, and there is a strong tendency to hæmorrhage from loss of tone in the contractility of the capillary vessels and the dissolved state of the blood. The *eye* loses its red colour, begins to assume a yellowish hue, first at the outer angles, while at the same time the yellowness extends down from the alae of the nose to the angle of the mouth; also around the eyes and borders of the lips, and between the lower lip and chin. The *tongue.*—The fur often remains moist, and still of a dirty white or leaden colour, but it most usually accumulates and becomes, at the same time with or before the adnata, of a brownish-yellow hue, and dry and darker towards the base, surrounded almost invariably by a moist, clean, red, or livid margin, extending along the sides and round the apex of the superior surface; the papillæ on the apex also frequently inflamed and swollen. The *lips* at this period are most usually dry and cracked, or somewhat parched; while *the pulse* sinks to 90, 80, or 70, rarely lower, varying a little more or less, from day to day, becoming at the same time soft and easily compressed. It was never observed to be intermittent but in a single case attended by Dr. Francis. The *skin* became comparatively cool, but still retained a higher temperature than natural. The heat and moisture of the surface were unequally distributed, the feet and hands often becoming cool, while the body over the epigastrium was preternaturally warm. In a great majority of cases, especially those of a mild character, the yellowness did not extend farther than over the face, blending with the partial flush which still remained, giving the countenance a yellowish red or damask hue. But in the severest cases it became of a greenish hue, and extended down the sides of the neck, over the scalp, to the chest, shoulders, and arms, gradually growing deeper, and spreading over the trunk on the eighth, ninth, and tenth days, but not reaching the lower extremities until just before or even after death. When this colour is perfectly formed, it has, if the complexion of the patient be fair, a pale lemon colour, and is of a greenish, mottled, or bruised appearance; in some instances darker, and resembling a vegetable stain; in others the appearance of a dead body which has begun to putrefy. Where the deep yellow tinge spread entirely over the trunk, the disease proved almost invariably fatal. Petechiæ about the forehead, cheeks, and neck, especially on the backs of the hands, and on the arms and chest, were often observed, and occasionally a vesicular eruption about the corners of the mouth.

The respiration continued perfectly natural and easy, except that the sighs became deep, long, and frequent. The *stools* occasionally became fetid and dark, but often remained natural to the last. At this stage of the disease the patient began generally to reject his drinks and medicines, and about the third or fourth day of the disease to complain of a soreness, tenderness, slight burning, or irritability at the pit of the stomach, pressure over which caused great distress, as well as very cold or hot drinks; at the same time, the heat seems to be concentrated in the region of that organ. In most cases this irritability was unaccompanied with nausea, but sometimes there were distressing flatulence and cardialgia from the beginning of the

disease. The *urine* was now generally diminished, and of a deep yellow colour, where the yellowness had extended over the trunk, and sometimes it was entirely suppressed for a few days; mostly a fatal symptom.

The *countenance* was usually more or less anxious and melancholic, or marked by an expression of pensive sadness; hardly ever entirely deprived of its florid colour, though somewhat modified or changed to a damask hue, by being blended with the yellow. The intellect was often more or less affected; sometimes muttering delirium was present, but never long continued; also more or less coma at times; most usually constant pervigilium, occasionally interrupted by dozing; the eye frequently had a wild, fixed gaze, and the patient appeared inattentive to what was passing; disinclined to talk, but always promptly answering questions. Convulsions occurred in one case only.

Third stage.—This stage continued from two to four, five, six, or even to seven or eight days. The transition from the second to the third stage is much less perceptible than from the first to the second; the symptoms being all rather aggravated than changed. The countenance becomes more anxious, the adnata of the eye of an unnatural green-yellow of the deepest hue, and entirely clear of red vessels, which, contrasted with the brilliant colour of a blue or hazel cornéa, gives the look an unnatural and grotesque appearance. The wild stare is rarely seen at this period.

The aspect of the face does not materially change, but the yellowness in fatal cases, and sometimes in severe cases that recover, gradually extends down the body and limbs. Occasionally there is furious delirium; and sometimes the skin, circulation, and other organs all appear to assume their natural and healthy functions. Exacerbations and remissions, as the frequency of the pulse, heat of skin, &c., were frequently observed, giving the disease somewhat the character of a remittent. The extremities now begin to loose their heat entirely, and are covered with a cold, clammy moisture, which finally extends over the forehead, shoulders, chest, and thighs, the surface at the præcordia still retaining its heat. The tongue cleans, or sloughs off, and becomes dry, and of a fiery, deep red colour, sometimes moist, but very frequently having its surface parched brown towards the base, and rough to the feel. The gums and inside of the lips become spongy, and of a deep florid red colour, while the lips externally, perhaps, are pale or livid. Blistered surfaces now become red, as if inflamed, and in many cases the conjunctiva lining the eyelids becomes deeply injected with blood. Blood, also, of a bright florid hue and watery consistence, distilled, in many cases, from the gums and nose, and besmeared the tongue, or becoming dry on the teeth and lips, incrusted them with a black sordes. If the stomach become more irritable, as most usually happened at this period, the patient complained of a distressing burning, and incessant, though not acute, or darting sensation at the præcordia, causing him to wince or cry out on the slightest pressure. Sighs are more frequent, also hiccough. The distress and burning sensation at the stomach generally increased about the sixth, seventh, or eighth day, the patient rejecting every thing swallowed; he now begins to vomit up, from time to time, a reddish-brown, turbid-looking, insipid, and perfectly inodorous matter, resembling coffee-grounds, or blood that has undergone partial change. In this coffee-ground matter was often observed transparent pieces of gelatinous matter, here and there streaked or tinged with florid red blood.*

The alvine discharges, which had been dark and offensive at first, often became perfectly natural in smell, colour, and quantity, and continued so to the last; there was nothing particularly offensive in the breath, sweat, stools, urine, or other excretions, as in typhus; nor was there any foul cadaverous effluvium from the body, as in that disease. The restlessness and inquietude now increased in fatal cases; the face, cheeks, and lips became bloated and livid, and the respiration hurried and painfully laborious, as in some cases to resemble asthma; the muscular strength is wonderfully retained, so that the patient is often able to walk about a few moments before dissolution; while the intellectual faculties, though somewhat obtunded, are still retained in comparative integrity to the close of life. Frequently the patient lay tranquil and unconscious of danger, and expired without a struggle. As remarked by Dr. Rush, "in some the last hours of life were marked with great pain and strong convulsions, but in many more death seemed to insinuate itself into the system with all the gentleness of natural sleep."—(*See* Townsend *on Yellow Fever*, p. 143 to 168.)]

26. II. Appearances after Death.—These vary remarkably with the form and character of the malady.—*A. In the most malignant* and rapidly fatal cases, a lemon tint of the surface, with livid or dark blotches, is generally observed. The ears, fingers, penis, scrotum, and in some the hands and arms soon become of a dark or brownish hue. The *muscles* are softer and flabbier than natural, of a dirty or dusky hue, and are easily broken down by pressure. The substance of the *heart* is similarly changed. Softening or greater friability of the tissues, soon after death, is generally remarked, and is extended to all the organs and viscera. The *body* seldom appears to suffer any diminution of its bulk, as in other fevers; and when the

[* "When the coffee-ground matter," says Dr. Townsend, "was examined by the solar microscope, it appeared to be an inorganic mass. Strained through coarse linen, and dried on paper, it retained its dark brown and red colour, and, by the mucus which it contained, adhered to the paper in streaks. When the residuum of the first straining had been passed through fine muslin, and an impression taken off with white paper, I found it to be of a dark-brown powder in fine particles, resembling minute scales of smoky mica, both in the colour, feel, and general appearance. I am inclined to believe that the matter of black vomit consists chiefly of the red globules of the blood, which, from the dissolved condition of this fluid when poured out from the exhalants, have easily separated from the other constituents, and become decomposed, or disintegrated by lying in the stomach, or by the action of the gastric juice or other secretions of this organ. There is also more or less of the same kind of dissolved blood, which oozes from the gums, nose, &c. We see, also, that this blood, which distills from the nose and gums, acquires the same colour as black vomit, but becomes dry on the lips and teeth, in consequence of exposure to the air; whereas the matter of black vomit is held in a fluid state by the heat and secretions of the stomach. Sometimes the formation of the matter of black vomit is first announced in the alvine discharges, succeeded soon afterward by the ejection of the same matter from the stomach."—*An Account of the Yellow Fever as it prevailed in the City of New York in* 1822, p. 153. By P. S. Townsend, M.D.]

fatal issue has been rapid, and the quantity of black matter vomited not very great, the several viscera are more or less congested, and the body seems even more tumid than natural, as well as discoloured, presenting a marked putrid or malignant aspect, and indicating a remarkably rapid loss of the vital cohesion of the several textures. In such cases as present any diminution of the bulk of the body, the muscles are paler, softer, and more flabby than usual; the viscera paler and softer, and even somewhat shrunk; and the blood-vessels contain very little blood. In these cases, a very large portion of the blood has been exuded from the digestive mucous surface, and been thrown off during life, in the form of black vomit, or of passive hæmorrhages from the alimentary and other canals.

27. The *liver* is changed chiefly as regards its cohesion and degree of congestion. It is almost always softer and more friable than natural; in some cases congested, in others pale, according to the quantity of blood evacuated during life, in the form of black vomit. Light olive-coloured patches are sometimes observed in it. The *gall-bladder* most frequently is shrunk, and contains little or no bile. The *spleen* and even the *pancreas* are somewhat softened; and the former frequently congested. The *œsophagus* and *stomach* present discoloured streaks or patches, of a dirty purple, dark, or livid colour, in their mucous surface, and the latter viscus often contains more or less of a similar fluid to that constituting the black vomit. In cases where the quantity of this fluid thrown off has been great, the stomach, intestines, and other viscera are paler, but also much softer than natural. The *small* and large *intestines* are often contracted in parts, and occasionally introsuscepted. In other respects they offer the same appearances as noticed in the stomach, but in a less degree. They often contain small quantities of fluid similar to that voided shortly before death; but this presents neither a bilious nor a fæcal character. The *epithelium* of the digestive mucous surface seems to be more or less detached in the several portions of the canal; and the mucous membrane is softened and readily separated from the adjoining tissue. The *follicular glands* are not prominently affected, farther than being somewhat enlarged in some instances. In those cases which present congestion of the chief organs, as of the brain, lungs, auricles of the heart, liver, and kidneys, slight serous effusion, sometimes sero-sanguineous, is occasionally, also, found in the *chief cavities*, particularly the pericardium and arachnoid, and but rarely in the peritoneal and pleural cavities. The *urinary bladder* is always empty and contracted.

28. *B. The more protracted cases of this pestilence* present changes depending much upon the symptoms during life, and most upon the continuance or amount of black vomit, and of black fluid discharged by stool. In many instances the appearances found agree in all respects with those above described. In others, the *liver* and *spleen* are remarkably congested and softened. In some, the liver is changed more or less in colour as well as softened. It is often of a pale olive hue, or it presents a mixture of yellow and green, and of dark green in streaks. Arejula mentions a change of colour in the liver to a reddish brown. But the other changes detected furnish no evidence of inflammatory action in this organ. Dr. Gillkrest notices a remarkably pale colour of the liver in females and children, and a marked absence of bile from the biliary ducts. The *gall-bladder*, however, frequently contains bile of a thick consistence and dark, tar-like appearance. The *stomach* often contains the matter of the black vomit. Its mucous surface, as well as that of the *duodenum* and *œsophagus*, is frequently discoloured in patches, in a few instances paler than usual, and in all much softened. The epithelium of these parts is generally detached; and Dr. Jackson remarks that he has found the villous coat often abraded, loose, and partially separated. A black, jelly-like substance is sometimes found in the *intestines*. Dr. Gillkrest states that this substance is sometimes found in the jejunum, but oftener in the ileum, and that it is occasionally found in both the stomach and the ileum, the intervening jejunum not presenting a trace of it. He adds, that he has found this substance in these situations even in cases where no black vomit had existed before death. The glands of Peyer are generally unaffected. The villous surface of the *colon* and *cæcum* is generally softened, discoloured in parts, and covered by an adhesive black substance. Frequently, on removing this substance, the membrane underneath is seen paler than natural. In a few cases, the fluid contained in the bowels is of a reddish tint, and more nearly approaches the appearance of blood. The intestinal canal is often irregularly contracted in parts, more rarely with portions introsuscepted, and in some instances, in addition to the matters now mentioned, an albuminous, dirty pale substance is found in the colon.

29. The states of the *heart* and *lungs* depend chiefly upon the quantity of blood exuded during the last stage in the form of dark vomit. When very much has been evacuated, but little change of these organs is observed beyond collapse and softening. In other cases more or less congestion is frequent, the blood being fluid, grumous, but not always very dark. False polypi are sometimes found in the cavities of the heart. Within the *cranium* congestion is the most common change, but this is not constant. Occasionally slight opacity of the arachnoid, with slight serous effusion, and in rare instances, sero-sanguineous exudation, are remarked.

30. These are the chief alterations found in cases of true hæmagastric pestilence, when the examination has been made a few hours after death; but farther changes take place, and are often confounded with the foregoing, when the inspection has been delayed even some hours later. The disease is rarely observed, excepting in such high ranges of temperature as preclude delay in *post-mortem* examinations, if the changes which appertain to the disease are the objects of investigation. Doubtless, however, the circumstance of rapid dissolution of the structures after death, and the ascertainment of the parts which are the first to experience such rapid change, are matters of great moment in estimating correctly the nature of the malady; and so highly do I consider their importance, that I am desirous to direct more at-

tention to them than they have hitherto received.

31. III. Diagnosis.—From the description now given, it will be perceived that sporadic, occasional, or scattered cases of this distemper, and the earliest of those occurring when it assumes the form of a devastating pestilence, will often be recognised with great difficulty, and be liable to be mistaken for the more malignant cases of *remittent fever* (see art. Fever, § 233, *et seq.*); or even for the *inflammatory seasoning fever* (§ 359, *et seq.*) to which Europeans are subject when they migrate to intertropical or warm climates. The difficulty is chiefly owing to the mildness of the symptoms in some instances, and to the circumstance of yellowness of the skin, and vomiting of a dark brown or black fluid being observed in many of those cases as well as in the true hæmagastric disease. The mild character of the symptoms in some persons, the disease appearing merely as an ephemeral fever, or in a form but little more severe, is analogous to what is observed in respect of other infectious maladies, which frequently assume a most malignant character, as smallpox, scarlet fever, &c.; nevertheless, the infectious effluvium proceeding from mild cases propagate the malady equally with that from the most virulent, and often give rise to the latter, while the latter frequently occasion cases of the former character, the violence of attack depending chiefly upon the predisposition of the individual affected.

32. There are certain phenomena which serve more especially to distinguish this pestilence from the malignant cases of fever with which it has frequently been confounded, and from which it is distinguished with great difficulty, especially in warm climates and localities, and in hot seasons. The former is more silent, insidious, yet rapid in its course; the latter more open and phlogistic. As soon as the body appears to be infected by the hæmagastric distemper, there are furnished indications of a greater or less shock sustained by its vitality, and of a marked contamination of the circulating fluids, and even of the soft solids; and these indications appear earlier and more decidedly in this distemper than in the fevers for which it is liable to be mistaken. Jactitation, mental depression, apathy or delirium, appear much earlier, and in a more marked degree at the outset. The lemon colour of the skin is also earlier; and such also is the case with the nausea and vomiting, which is more distressing than in those, and the quantity of fluid thrown off, at first, and sometimes throughout, colourless, or nearly so, is much more considerable, without reference to what has been taken into the stomach. It is evident that the fluid ejected is chiefly an exudation or secretion from the stomach; that its great amount must more or less diminish the serous portion of the blood; and that in those cases which are attended by black vomit and discharges of blood from mucous canals, the diminution of, and other changes in, the blood, must be still more considerable. In these, more especially, the vomitings often occur without retchings or effort.

33. The character of the pulse is of importance; and in respect of it, the rapid rise in frequency soon after the attack; the soft and asthenic condition; the weakness, inequality, irregularity, and subsequently the slowness, the intermissions and smallness of it, are more or less remarkable. The red, suffused state of the conjunctiva, with brilliancy of the eyes in the young and robust, but without this brilliancy in the aged, and at an advanced stage; the lurid redness or suffusion of the features, in the former class of subjects, and the depressed and anxious expression in all; the severe pain, deep in the orbits, and the drunken-like appearance of the eyes; the red, raw, clean, and smooth, or bloody state of the tongue; the pain and soreness of the throat, pharynx, and along the œsophagus; the acrid burning sensation at the stomach, constriction in the chest, and anxiety and burning pain at the præcordia; the thick, compacted feeling furnished by the skin, the diminution of its sensibility at an advanced stage, and the dingy tint of it, with leaden or livid patches, at last; the singultus; the scanty secretion, or complete suppression of urine; the costiveness, absence of bile from and state of the stools; and the flaccid, leucophlegmatic, swollen, and pallid appearance of the soft solids, without very evident emaciation in most instances, but with an appearance of morbid plumpness, or turgidity in the more malignant and rapidly fatal cases, serve farther to distinguish the malady.

34. Vibices and livid patches are characteristic both of the pestilence itself, and of the advanced and fatal period of it, and depend upon the alteration that has taken place in the constitution of the blood, as well as in the vitality of the capillary vessels, both venous and arterial. The delirium is generally different from that observed in the worst forms of remittent fever. It is characterized by a peculiar imbecility, fatuity, and apathy, and by faultering of the voice, or stammering. Furious or violent delirium rarely occurs unless in the early stage of febrile excitement. The pupils of the eyes are usually dilated, especially during an advanced period of the malady, and frequently even at an early stage, when the conjunctiva and countenance are suffused and injected—a state of the pupils which is not observed in yellow remittent fever. The pains in the legs are also different from that complained of in other fevers, and are generally felt where the gastrocnemii and soleus muscles unite to form the tendo Achilles.

35. The yellowness of the skin, in the hæmagastric pestilence, is either a pale yellow or a dingy tint, often presenting patches of a dirty yellow or livid hue: in the *yellow remittent fever* the colour is more complete and deep than in the former, and more manifestly the result of biliary disturbance; while the discoloration of the pestilential malady arises from vital exhaustion, manifested chiefly in the capillaries and in the blood itself. M. Guyon very justly remarks, that in the latter the colouring of the skin is owing to the presence of blood which stagnates in the capillaries, or which escapes from them, and is nothing else than the tinge of a contusion; while in the remittent fever the colour is owing to the presence of bile, and is that of true icterus. This alteration of the blood and of the vital condition of the capillaries is evidently the source of the black vomit, and of the dark colour of the evacuations, in the

last stage. The singular spasmodic force with which the fluid is often ejected from the stomach; the presence of hiccough when the dark matter is less copiously thrown off; the peculiar dark stain which this matter imparts to linen, and which is not easily removed; the raw and unpleasant odour, which, as Dr. W. BARRY remarks, "is so peculiar, that, on entering the chamber, the state of affairs becomes immediately manifest," serve farther to distinguish the malady. The early appearance of a dingy yellowness on the neck and chest, and the state of the patient's mind, even when there is no delirium, are also worth remarking. The sufferer is generally either unconscious, or quite indifferent to his hopeless condition, and expresses himself as being much better, until vitality, receding from the extremities and external surface, ceases altogether in the central organs. During the last flickerings of the expiring flame, there are often observed incoherent expressions, violent straining of the eyeballs, and convulsive motions, rapidly passing into dissolution.

36. About the end of the second day, or during the third day, the patient begins to complain of a violent pain in the testes, with contractions of the spermatic chord towards the abdominal ring. On examination, the testes feel much diminished in size, are drawn towards the abdomen, and the scrotum is flaccid and empty. The surface of the scrotum soon after becomes very painful, and an excoriation takes place on the surface, chiefly of the most depending part, from which much offensive puriform matter issues. At the same, time a similar discharge often takes place from the urethra, which ceases as the symptoms become favourable, but which becomes bloody, ichorous, and insufferably fetid, when dissolution ensues. The most violent attacks are generally attended, in the last stage, by an offensive and ichorous discharge from both the scrotum and the penis, these parts frequently becoming more or less sphacelated and gangrenous shortly before death.

37. *A.* Besides the *diagnosis* depending upon the presence of certain symptoms characterizing the hæmagastric pestilence, which are not observed in the worst forms of *remittent fever*, the origin and course of the former, compared with those of the latter malady, should not be overlooked. Malignant or bilious remittent fevers, even in their most intense grades, proceed entirely from malaria, or emanations from endemic sources of disease of a more or less concentrated kind (see ENDEMIC INFLUENCES), and present more or less marked *remissions*. In many of the situations furnishing these emanations, dead animal matter, as well as dead vegetable matter, aided by a deep, rich, absorbent soil and great humidity, performs an important part. Still the resulting malady does not produce a specific effluvium, capable of itself to propagate a similar disease, at least in ordinary circumstances; and if ever such a phenomenon occurs, it can take place only under peculiar circumstances, which furnish a new and superadded cause, as shown above (§ 12, 13), this cause giving rise to a very different malady from that which arose from endemic causes, however concentrated or intense.

38. On the other hand, the hæmagastric pestilence appears independently of endemic or terrestrial sources or malaria, and proceeds from an infectious or contagious poison, which, however formed *originally* (see, hereafter, § 139, *et seq.*), infects the healthy by contaminating the air immediately surrounding those already affected; or which, being absorbed and retained by other bodies (as shown in the article INFECTION, § 16, 17), is afterward given out from them on exposure to the air, thereby contaminating and infecting the air and adjoining objects.

39. The *course*, also, of hæmagastric pestilence is generally different from that of yellow remittent fevers. The former malady is not only much more sudden in its seizure, but also more insidious, silent, *continued*, and rapid in its course than the latter. The one, even in its most intense grades, as I have observed them in Africa, where they are most malignant, very rarely ending fatally before the eighth, ninth, or tenth day; the other generally terminating life before the first of those days, and frequently as early as the second day. Mr. FRASER, whose experience of this pestilence in Gibraltar was frequent and extensive, observes that a variety of very striking symptoms, rarely seen in the fevers of the country—such as tremours and nervous agitations; singultus; extraordinary mental aberrations; an unexampled range of hæmorrhages; affection of the urinary evacuation, vomiting becoming seemingly vicarious of urinary discharge; a peculiar odour perceptible on approaching the sick, this odour being presumed to occasion the infection of the healthy; quick and perfect recoveries from violent attacks, with little or no risk of relapse, or of consequent visceral diseases—sufficiently distinguish this malady from all others. He farther adds, that the seizure of this malady is characterized by peculiar dejection of countenance, pain in the orbits, often attended by a peculiar delirium, similar to the effects of narcotics, or of poison on the nervous system, causing algor, tremour, anxiety, sighing, singultus, and sudden death. The course of it, he says, resembles that of the exanthemata, viz., a synochal stage of sixty hours, suddenly terminating in apyrexia, or running into malignant or putrid symptoms, unattended by remissions, but with vespertinal exacerbations, and with a fallacious calm, similar to that which marks mortification, and closing generally, in fatal cases, before the seventh day; recovery protecting from a second attack. While, on the contrary, *endemic* or *yellow remittent fever* is a disease of high arterial action (in the Mediterranean), with that turgescence of countenance which usually attends pneumonia, with a general sense of fulness in the encephalon, and throbbing of the temple, but with little delirium; is much more prolonged in its course, and accompanied with heat of surface, and often with bilious yellowness; sometimes terminates in intermittent fever, or in visceral disease; is very prone to relapse, and second attacks are common. (*See art.* FEVER, § 225, *et seq.*)

40. It is not only upon the characteristic symptoms, *continued type*, and course of this pestilence, compared with those of remittent fevers, that the diagnosis is to be based, but also upon the cause, origin, and propagation of it—upon its infectious nature—*infectious* in the

sense which I have attached to the term (*see art.* Infection, § 13, 16), or contagious, without direct or immediate contact between affected and healthy persons; a property admitted not to exist in respect of remittent fevers, even of the worst forms. This subject, however, as it involves the most important considerations, and as having called forth the most virulent and ungenerous discussions, will receive a fuller consideration in its more appropriate place.

41. *B.* Hæmagastric pestilence differs from the *plague*, in being attended by more violent febrile excitement; in the absence of carbuncles and buhoes, the lymphatic glands being enlarged only in the most intense and fatal cases, and in few instances only; and in the occurrence of the black vomit, which is very rarely observed in the latter pestilence. Undue importance has been attached to the circumstance of the former appearing during a high degree of temperature, which would put a stop to plague; for, although hæmagastric pestilence generally requires a high range of heat, still it will often continue to prevail, after it has become epidemic, during very temperate states of the atmosphere. Doubtless, however, the plague will continue to prevail during low ranges of temperature—ranges which will altogether arrest the progress of the hæmagastric pestilence.

42. *C.* The milder cases of this malady are distinguished with great difficulty from *common continued fever*, for some of these not infrequently assume the form of ephemeral fever, or of simple inflammatory fever; others, that of bilions or gastric fever; others, that of the seasoning or ardent fever of Europeans recently arrived in warm climates; some resemble adynamic fever, and others true typhus. The predominant affection of a particular organ; the more sthenically inflammatory character of all the symptoms, especially of the pulse; the more diffused pain in the head and forehead; the states of the eyes, of the evacuations, and of the skin, attending *inflammatory fever*, will readily distinguish it from this pestilence. When this fever occurs in Europeans lately arrived in a warm climate, or assumes a more intense form, or that of *seasoning fever*, the diagnosis may be much more difficult; especially when, as is not infrequently the case, much biliary derangement and gastric irritability are present. In these cases the conjunctiva and skin may become yellow; and blood may be exuded in some instances from the digestive mucous surface, and impart a black grumous character to matters ejected from the stomach, or evacuated from the bowels. Here the diagnosis is difficult, particularly when such cases occur only occasionally. Still, the close observation of even a few cases will enable the physician to recognise the character of the disease, which is always preceded by distinct præmonitory symptoms, is inflammatory at the commencement, and is attended by a free discharge of bile—phenomena which are not met with in this pestilence. Seasoning fever is, moreover, of longer duration than this malady; and in many localities, or during or subsequent to the rainy season, generally presents more or less, or lapses into, a remittent type, and is often followed by visceral diseases — occurrences which are not met with in the hæmagastric malady.

43. *D.* Hæmagastric fever can hardly be confounded with *typhus* or *typhoid fevers*, for the prominent symptoms, the course and duration of each, are altogether different. Dr. Bancroft, whose writings on this pestilence, and on the causes of pestilential diseases, have misled the inexperienced, and long mystified many, has stated the circumstances in which the former differs from the latter; but his statement (see p. 51 of his work) betrays a remarkable ignorance both of true yellow fever and of typhus. Indeed, I doubt much his having seen a case of true hæmagastric fever when he published his Gulstonian Lectures, delivered at the College of Physicians in 1805, and which constitute the substance of his work on yellow fever; or, if he had seen any cases of this pestilence, he must have confounded them with the more malignant cases of remittent fever, as his remarks on the diagnosis, and much of his description of the former, are much more applicable to the latter than to it; indeed, throughout his work he evidently confounds the hæmagastric malady with malignant remittent fever, and considers them identical diseases; for he nowhere attempts to distinguish between them; and he merely points out, in a manner the most imperfect, certain points of difference between yellow fever, plague, and typhus; hut in a way altogether worthy of the Coryphæus of the non-infectionists.

44. The symptoms which have been above enumerated (§ 7, *et seq.*) solely appertain to this pestilence, and so certainly indicate it, that, should a patient present them in a country liable to be afflicted with it, or in an European sea-port, holding intercourse with parts in which it is epidemic, during warm or temperate seasons, we may be assured that a case of it has occurred; and this assurance should give rise to measures hereafter to be indicated. If the case be a solitary one, or if only a very few such occur—and if isolation and other early precautions be taken, this may be the result—the fact may be disputed in the special-pleading mode in which the subject has been recently discussed; and the more especially if the patients recover, or if no examination of the bodies of those who have died has been made; for in these the black vomit and several of the other pathognomonic symptoms may have been wanting. The circumstance of the disease, particularly when epidemic, frequently assuming a mild form, should not be overlooked; for among a certain number of cases at the outbreak of the pestilence, a small proportion may only present the black vomit, several of the rest appearing only as a simple ephemeral fever. As M. Louis has well observed, in respect of the Gibraltar epidemic of 1828, although some of the symptoms of other diseases are similar to those of yellow fever, the symptoms taken together, and their progress, are very different.

45. In *typhoid fevers* vomitings are rare, while in this malady they are very common, frequent, and urgent; and, in the worst cases, they are peculiar (§ 8). Diarrhœa, more or less abundant, occurs in a large proportion of the cases of typhoid fever, and often also at the commencement of the disease; while an op-

posite condition of the bowels is observed in true yellow fever. The stools are also very different, both in colour and character, and are never so dark or blackish as in the latter malady. The form of the abdomen is natural in hæmagastric fever; there is usually more or less meteorismus in typhoid fevers. In true typhus there is a peculiar eruption on the surface of the body, a characteristic delirium and other febrile symptoms, and extreme prostration, not observed in the other malady. While typhus and typhoid fevers are slow in their course, the hæmagastric pestilence is rapid.

46. *E. Gastritis* may, in some circumstances, especially in warm climates, or when associated with hepatitis, be mistaken for hæmagastric fever. In both diseases there are more or less frequent vomitings, attended by burning epigastric pains, anxiety, &c.; but the duration of gastritis is generally longer than that of this fever, and the anxiety is less. The yellowness of the skin is absent, unless when gastritis is complicated with hepatitis or with disease of the biliary ducts; and when such is the case, the yellowness is a true jaundice, and not that of this pestilence. Besides, the intense pain of the orbits, the appearance of the eyes, the blackish stools, the suppression of urine, and, in fatal cases, the black vomit of this latter malady, are not present in the former.

47. In *hepatitis* there is yellowness of the surface, but with these are also more or less severe pains in the right hypochondrium, and an increase in the volume of the liver, as may be readily ascertained by examination of the trunk and by percussion, no such increase taking place in this pestilence. Then the severe pains in the orbits and the injection of the eyes at the commencement, the anxiety, and the several nervous symptoms, so constant in this latter, are not observed, while the course of it is so much more rapid than that of hepatitis.

48. *G.* In fatal cases the *post-mortem* examinations generally will decide the question as to the existence of the hæmagastric malady; for in them the presence of the peculiar black matter in the stomach or intestinal canal, or in both; the absence of material alteration of Peyer's or Brunner's glands; and the usually *yellow colour* of the liver, independently of other very manifest organic changes, are especially characteristic of this malady. M. Louis observes, "that if the liver be found of a more or less pale yellow, its cohesion and consistence natural or increased, all doubts as to the disease should be removed." But the consistence of the liver is not infrequently diminished, and the colour of the liver is rather that of rhubarb than a pale yellow, and is often such as described above (§ 27, 28). The pale yellow colour of the liver, considered so diagnostic of this pestilence by M. Louis, was also insisted upon in the very excellent work of MM. Francois, Bally, and Pariset on this malady, as they observed it in Barcelona in 1821; but in the numerous dissections they made during that epidemic—one of the most prevalent and destructive on record—they particularly notice the rhubarb colour of this organ.

49. iv. Prognosis.—It is only from a very close and attentive scrutiny of the several symptoms individually, and of their combination, as constituting the general state of the patient, that a correct opinion can be formed of the event in this malady.—*A.* The expression and appearance of the eyes, the general aspect of the countenance, the torpor of the system, the depression of the spirits, and the imbecile state of the mind, described under the last stage of the malady (§ 16), afford the worst, and the reverse of these symptoms the most favourable, prognosis. Tremours of the hands and lips; restlessness; violent spasmodic contractions of the legs or arms; aphthæ, resembling curd, on the tongue or gums; dark spots or specks around the mouth or on the upper lip; hæmorrhages from the nostrils, mouth, anus, urethra, or vagina, or from the eyes, ears, or pores of the skin, especially when the blood is dark, decomposed, or ichorous, or has an offensive odour, and the parts from which it proceeds have a raw or a sphacelated appearance, and sphacelation of the scrotum or penis, are fatal symptoms.

50. Pain in the fauces and throat, descending in the course of the œsophagus, with redness of the tongue and pharynx; a burning pain in the region of the heart, especially when attended by great agitation, or by an expression of despair in the countenance; a change of voice, from the usual manly sound to a weak treble, or to a tone much weaker, softer, lower, and shriller than the natural one, the words being drawled out in a strange whining manner, particularly when this change of voice occurs early in the disease; very scanty, offensive, and discoloured urine, or its dark, greenish, blackish hue, or its suppression, or its passage in drops with severe pain above the pubis and in the urethra, with retraction of the penis; petechiæ, vibices, livid spots and patches on the surface; enlargement of the glands of the groins, armpits, and angles of the jaws; vomiting of black, grumous, or flaky fluids, are, even when existing singly, most dangerous symptoms; but when several of them are present, they preclude hopes of recovery.

51. When the disease appears with early symptoms of malignancy; when the pain in the head is intense, and confined chiefly to the lower part of the forehead, the orbits, and eyeballs, the conjunctiva being red, and the face deeply flushed; when a violent or a melancholic or despondent delirium occurs early, or a fixed opinion that death will ensue is entertained; when the pulse is full, very soft and very rapid; or irregular, unequal, intermittent, or, at least, slower than natural, small and weak; when the skin is very harsh and hot at the commencement, and cold at an advanced period, the patient complaining of burning internal heat; when the tongue is red, smooth, flabby, or covered by a sanguineous exudation; when yellowness or a mottled state of the skin, patches of discoloration, and black vomit appear, and especially if either or all supervene early in the disease; when exudations of uncoagulable blood take place from the mouth or other outlets of the body, or the quantity of black fluid thrown up is great; when singultus is attended by extreme anguish and restlessness, or with muttering, moaning, or with a weak, sharp, or wild, unnatural tone of voice; when the urine is suppressed, or the evacuations are black, grumous, or watery; when the extremities become livid, cold, or mottled, and the patient

lies on his back; then, whether these symptoms appear either singly or combined, recovery very rarely takes place, and never when the lips are cherry-red and tumid, the eye glassy or glistening, the skin damp, flabby, torpid, and presenting streaks or patches of a livid, greenish, or violet colour, and when a nauseous odour issues from the body. Recovery is also never observed after violent hiccough occurring late in the distemper, especially if it be attended by discharges from the stomach without effort, or with loud, flatulent eructations.

52. *B.* On the other hand, hopes of recovery may be entertained when the distemper is mild at its outset, or during the first three days; but even in some such cases the malady proceeds so insidiously as suddenly to present many of the most unfavourable symptoms on the fourth or fifth day, more especially yellowness of the skin, black vomit, suppression of urine, &c. The longer the stage of excitement continues, provided that the symptoms do not increase in severity, the event is the more likely to be favourable; and this may be expected with more reason when an agreeable, warm, and general diaphoresis breaks out; when the irritability of the stomach ceases; when the eyes become more lively or natural, the discharges more healthy, and the urine more abundant. On the contrary, when the stage of excitement quickly or abruptly passes into the state of apyrexia preceding the stage of vital exhaustion, the worst form of this last stage, with delirium, coma, and the several signs of malignancy above enumerated (§ 23), may be expected. If unfavourable symptoms do not appear before the fifth or sixth day, very reasonable hopes of recovery may be entertained. Mr. Fraser, whose experience of this pestilence has been most extensive, states that he "never had reason to be apprehensive of the issue after the sixth day, unless fatal symptoms had already set in."

53. If epistaxis occur early, or during the stage of excitement, and be moderate, and attended by amelioration of the cerebral or other symptoms; if the pulse is neither very rapid, nor very weak, nor very soft during the second day; if the skin remain at an early stage soft, and without the caustic heat above mentioned; if a miliary eruption break out; if a quiet sleep takes place, uninterrupted by vomiting; if the patient lie on the side, and draws the clothes around him; if the urine be voided in some quantity, and without pain in the urethra or glands; if the evacuations become more copious, feculent, or bilious; if the tongue, from being dry, turn to moist, hopes of recovery may be entertained; yet a guarded prognosis should nevertheless be given.

54. *C.* Dr. James Clark, one of the earliest and most experienced writers on this malady, observes, that if the yellowness appeared in 24 hours or 36 hours after the first attack; if the case had been left to nature, or the patient had been bled, and no powerful remedies attempted, recovery never took place. The sooner the febrile stage ended, he adds, when the case was left to nature, or only simple remedies were used, the greater the danger; and, on the contrary, the sooner the fever was subdued by powerful remedies, acting in an evident and decisive manner, the greater chance the patient had to recover. If the debility was not great after the febrile stage, and the yellowness did not appear before the fourth or fifth day, the sick generally recovered. Many also recovered after the yellowness, and even after bleeding at the nose; but in all his practice he recollected only four patients who recovered after black vomit had appeared (p. 18). Of the cases which I had an opportunity of treating many years ago, one only recovered after this symptom had fully and unequivocally manifested itself. It should, however, be remarked, that vomiting of a dark grumous fluid, occurring with or after yellowness of the skin, not infrequently occurs in the last stage of malignant, bilious, or remittent fever (*see* Fever, § 233, *et seq.*); and that recovery occasionally takes place in that fever, even after these symptoms have appeared. But the case is very different in the true hæmagastric pestilence. Most of the instances of recovery which we hear of from the black vomit, are recoveries from these states of yellow or remittent fever which have been confounded with this pestilence.

55. Dr. Chisholm states that the critical periods or days are more distinctly marked in this malady than in any other observed in warm climates. The cessation of the disease, and the death of the patient, he remarks, always happened on the odd days; but the change in the state of the symptoms which preceded either event took place on the even days. Thus, if the patient was worse on the evening of the second day, he would die on the third; if worse on the fourth, he would die on the fifth; and so on as far as the fourteenth day. In the same manner, if the patient was better on the second, fourth, or sixth day, the resolution of the disease would happen on the following days.

56. *Pregnant females* always experience abortion, which is attended by excessive hæmorrhage, when attacked by this pestilence, and very seldom recover; and when women are seized by it the first fortnight after delivery, recovery rarely or never takes place. Dr. James Clark states that, during the epidemic in Dominica in 1793 and 94, children, adults, and old people, labouring under smallpox, were generally attacked by this pestilence "about the time that the secondary fever usually comes on; and that none recovered but those who had begun to take bark and wine after the eruptive fever, and continued this remedy and a nourishing diet for some time after. It made no matter whether the smallpox were of the confluent or distinct benign kind. All fell victims to this disease who were not treated in the manner just mentioned."

[The individual prognosis in this disease, as Dr. Dickson truly remarks, is much modified by circumstances. In the sanguineous and plethoric the disease is apt to attack with more violence, and run its course with greater rapidity. The intemperate, with scarcely an exception, succumb beneath an attack. It is even controlled, in some degree, by national habits and modes of life. The Germans, Scotch, and Irish stand a much poorer chance of recovery than Spaniards, Italians, and Frenchmen. The Englishman and the American from northern latitudes occupy a middle ground, generally speaking; the more recently a person is from the north, in places where the disease prevails,

the more severe will be his attack. The malady proves extremely fatal among young children.

Dr. Dickson has also called attention to the state of the stomach, as of paramount importance in inflammatory cases; every thing depending on its powers of retention and tranquillity. Where there is great burning at the epigastrium, with nausea and retching, and tenderness on pressure, the prognosis is bad. The pulse is not much to be depended on; but when it becomes small, quick, and irregular, it indicates danger. So also does a moist and relaxed skin. In bad cases, the febrile paroxysm is very short; after this has subsided, the supervention of febrile excitement is a favourable sign. But a sudden collapse, or gradual sinking of the strength at this crisis, attended with black vomit, shows a fatal result. A spontaneous suppression of urine, the defect of renal secretion, is almost uniformly a fatal sign. The black vomit, though not pathognomonic of yellow fever, is always, nevertheless, a most unfavourable sign, whenever it occurs in this disease, whatever may be the condition of the patient in other respects. Dr. Dickson states that he has met with as many as ten recoveries of patients who had black vomit; he has met with it, also, repeatedly in bilious remittent fever, gastritis, and enteritis, in one case of varioloid, one of catarrhal fever, one of pregnancy, and two of dropsy. We have observed it in several instances in other affections, and recently in a fatal case of peritonitis.]

57. V. Mortality.—But little can be stated respecting either the numbers attacked in a locality where this pestilence prevails, relatively to the amount of population, or the proportion of deaths to recoveries. It is obvious that, as regards the extent of diffusion of the distemper among the community, much will depend upon the means resorted to of guarding against it. As respects the epidemics which have occurred in Europe, and in some other places, the greatest fatality has been remarked among the early cases, or when the spread of the disease is reaching, or has reached, the utmost limit. Toward the decline of the epidemic the proportion of recoveries increases; and this may be owing either to the less predisposition of the affected; to the depression of the temperature about the close of an epidemic; to the most susceptible, the most timid, and most exposed to the exciting and concurrent causes, having been the earliest attacked; or to the joint operation of these circumstances. Much, however, will depend upon the ventilation, cleanliness, and measures of prevention adopted; and more especially upon the avoiding of all those causes which tend to contaminate the surrounding atmosphere, and even of those articles which the foul air may imbue.

58. Dr. Rocheaux states, that at Barcelona, during the early part of the epidemic there, in 1821, the mortality amounted to 19 out of 20 attacked; but it diminished to much less, and at the close of the epidemic was two thirds. Dr. Killkrest remarks, that at Gibraltar, in 1828, very few recoveries occurred among the earlier cases in the Civil Hospital. "Of the first 35 Jews received into the establishment," but one recovered. The unusual rate of mortality among this people may partly be referred to their very general (constitutional!) despondency when attacked by dangerous or epidemic maladies. In this epidemic at Gibraltar, one half the cases died in several of the military corps. It is stated by the physician just quoted that, of the first 134 cases treated in Murcia in 1803, not more than three or four recovered.

[In 1804, in Gibraltar, out of a population of 9000 civilians, but 28 persons escaped an attack, and the mortality was one in three. The disease proved nearly as fatal in Antigua, in 1803. Three out of four died of it in Jamaica, under the care of Dr. Hume. In Philadelphia, in 1820, 83 out of 125 died of it, which is about two out of three. In the city of Charleston, according to Dr. Dickson, the average mortality is about one in five or six of all attacked. But, as in cholera, the fatality of the disease varies greatly in different localities of the same city. Thus, in Philadelphia, in 1820, out of 12 reported cases in one vicinity, there was only a single recovery; of 70 in another locality, 30 recovered, and three out of four recovered in another vicinity. The general average of deaths from yellow fever where it prevails is about one third.]

59. The greater malignity, and consequently the greater fatality, of the cases have been observed not only at the commencement, but also at a far-advanced period, of some epidemics; as if the violence of the distemper had received a fresh impulse. Dr. Townsend states this to have obtained in New-York in 1822, the proportion of deaths to the affected being, as late as October, as three to four. On the other hand, a milder form of the malady has been more frequently observed in some epidemics and localities than in others. This circumstance may be partly attributed to the intensity and concurrence of those causes which predispose to, and determine or aid the more efficient and specific cause of the distemper, especially of a warm, confined, stagnant, and humid atmosphere; want of ventilation and of cleanliness; crowded sleeping apartments, &c. (§ 71); dread of the disease; the season, temperature, and situation. Much, however, of the different degrees of malignity said to exist in different epidemics, and in different climates and places, may be imputed to the circumstance of the malignant states of remittent fevers on the one hand, and the inflammatory remittent and continued fever on the other, being often confounded, by some writers, with hæmagastric pestilence, when either of the former has become remarkably prevalent, and has been attended, as they sometimes are, by yellowness of the skin.

60. Some of the epidemics of yellow fever said to have occurred in the West India Islands, and in parts of the American continent, have been much milder than the visitations of this pestilence have been in Spain during the early part of the present century. But it is by no means fully ascertained whether all the epidemics observed in the western hemisphere were actually the true yellow or hæmagastric fever, or merely an unusual prevalence of endemic or remittent fever, rendered more continued by intensity of attack, predisposition of the affected, and other circumstances. No doubt several of these epidemics were the pestilence under consideration. Their symptoms, remarkable

prevalence, and fatality proved that some of them were this distemper; but others were of a different nature; and probably some of them resulted from the crowding of a number of human beings in a confined space, either in barracks, or in transports, or between the lower decks of ships of war, in a high range of temperature, and without sufficient renewal of the air. Numerous instances of malignant and even of pestilential fever of an infectious nature have occurred in this manner, and have been recorded by writers, and some of them have been noticed in the articles on Epidemics.

61. Still the degree of mortality has varied much in most of the visitations of this pestilence which have been observed during the last half century, and must be attributed to the concurrence of several causes, especially to the predisposition of the attacked, the season and locality, to crowding of the population and of the sick, and to the amount of ventilation both before and after the seizure. The extent to which treatment may influence the proportion of deaths can hardly be estimated; and yet it doubtless, also, has very considerable effect. A recourse to "heroic remedies," in the language of some contemporary foreign writers, is certainly not attended with marked success; but much depends upon the nature of such remedies. For many years past medical practice was considered excellent in proportion to its activity, or, more justly speaking, to its violence; copious blood-lettings, large and frequent doses of calomel, &c., constituting sound and judicious, as it was no doubt active, practice in the eyes of the inexperienced.

62. All that can be said as to the rate of mortality in various epidemics and visitations of this pestilence, as far as the data have been furnished, may be stated as follows: 1st. Where the infection has been introduced among the natives of temperate countries, either removed to a warm climate, or during a very warm season, and especially if the population thus predisposed be dense, or living in a close, crowded, and ill-ventilated locality, and if the air be very humid as well as very warm, and much more so if it be stagnant or imperfectly renewed, the distemper has been not only the more violent, more rapid in its progress, and more fatal, but it also has been more rapidly spread. Thus the results have been most disastrous in towns where these circumstances have existed; and in ships of war, and in transports, particularly after storms or states of weather which induced the closure of gun-ports and hatches, thereby preventing the renewal of the air, and favouring the development of concomitant causes. The spread of the distemper has been the more general or almost universal, and the proportion of fatal results has been the greater, the more the above circumstances have predominated, the more completely ventilation, segregation, and cleanliness were neglected, or imperfectly attained; and the greater the panic or dread of the distemper.

63. 2d. When the distemper has appeared in a population of which a greater or less proportion has been formerly attacked, or has resided long in a warm climate, or consists of dark-skinned races, although such residence and race by no means confer immunity, as proved on many occasions; also when it has appeared in more temperate countries, at a time when the cold season is fast approaching, and where due ventilation, segregation, and other due precautionary measures have been taken, and confidence has been secured, it is much more limited in its diffusion, milder in its character, and less fatal. Thus removal to a more open and elevated locality, the strict quarantine of the infected, free ventilation, a lower range of temperature, and a cooling regimen, have severally tended both to limit the extension of the malady, and to diminish the proportion of fatal cases; while opposite circumstances have invariably increased both the one and the other.

64. VI. Causes.—Although this distemper is owing to a certain specific cause—and the existence of this cause will be demonstrated in the sequel—still the infection of the previously healthy will be favoured by other causes, which either *predispose* the system to the invasion of the specific cause, or *determine* or aid the development of this cause, if the system have previously been exposed to it. Thus the same influence may either *predispose* the frame to the reception of the infection, or *determine* the development of the malady, the infection having been received, but not manifested.

65. *A.* Of these causes or influences, which are rather *predisposing* than determining, the most important are age, sex, constitutional peculiarities, mental emotions, temperature, seasons, &c. The influence of these is apparent not merely in certain epidemics, but more or less in all, whether occurring within the tropics or appearing in temperate countries. Certain of these predisposing and determining causes are *intrinsic*, or appertain to the individual; others are *extrinsic*, and implicate more or less whole communities.

66. *a. Age* has a considerable *predisposing* influence in this as well as in several other epidemic distempers. Adult age presents a greater degree of susceptibility to infection than either childhood or old age; and this is manifested both at the commencement and during the height of an epidemic. Towards the conclusion of very general and devastating epidemics, a larger proportion of children and aged persons is observed to be attacked than at an earlier period of the epidemic; but this is owing, as in the epidemic of Barcelona in 1821, to the circumstance of the increased proportion of these classes remaining unattacked, or liable to be infected towards the close of the epidemic; nearly all those of adult and middle ages having caught the distemper. The more rapid and general infection of adults, and those at the prime of life, is probably in part owing to their greater exposure to the existing cause of the distemper; nevertheless, more or less of increased susceptibility of infection appears to exist during these epochs of existence, than in any other. A similar circumstance obtains in other infectious fevers, and shows that the primary impression of the exciting cause is made upon the organic nervous system; for if this cause acted directly on the blood, the aged and debilitated, the susceptible and the non-susceptible, the protected and the unprotected, would be equally liable to the contamination. Nevertheless, when the infectious effluvium is concentrated, or the exposure to it is more than usual, both children and old persons are attack-

ed, and some infants at the breast do not escape.

67. *b. Sex.*—The frequency of seizure in the two sexes differs much in different epidemics, owing very probably to the varying degrees of exposure of each to the exciting cause. In the epidemic of Barcelona, females were as frequently infected as males, but a greater proportion of the former recovered. Much will necessarily depend upon the state of society in the place where the distemper prevails; but in most epidemics a less prevalence, as well as less fatality, is remarked among females, as well as among children, than in adult males. This is probably owing in part to the state of the female constitution during the period of uterine activity.

68. *c. Constitution, Habit of Body, and Race.*—It has been remarked in almost every epidemic that persons of a robust constitution, those of a rigid fibre, the plethoric, and sanguine temperament, were the most frequently attacked, and had the disease in the severest form. However, when the pestilence became general in any locality, it has spared no constitution nor habit of body, excepting that which had previously been attacked. The greater immunity of the *negro race* has been often remarked, but with insufficient precision. Individuals of this race have, however, not infrequently been attacked, both in the West Indies, Africa, and in America; but the distemper in them has assumed a milder character (§ 6).

69. *d. The depressing passions*, more especially fear of the disease, the loss of relations, anxiety, disappointment, &c., all tend remarkably to predispose the system to the operation of the exciting cause. Irregular modes of living, excesses of any description, prolonged abstinence, fatigue of body or mind, and want of the requisite repose, exert a similar influence, although not so remarkably as the depressing emotions of the mind, and, with these, act both as predisposing and determining causes.

70. *e. Pre-existing disease*, and general feebleness of constitution, or debility in any form, certainly have no influence in predisposing to an attack, but rather prevent it. MM. BALLY, FRANCOIS, and PARISET state that this was very obvious in the epidemic of Barcelona; and that in their numerous inspections of bodies dead of the distemper, old visceral or pulmonary disease was very rare. They, however, remark, that syphilis did not protect from an attack; and that setons and issues appeared not to possess a prophylactic influence. They found that a few of the patients in the portion of the general hospital set apart for the insane were attacked, showing that insanity did not prevent the seizure of this pestilence. The chief of the *intrinsic* influences now mentioned, which seem to act also as determining causes, or which appear to aid the operation of the specific cause on the frame subsequently to exposure to this cause, are, the depressing emotions of the mind, excesses of any description, want of the natural repose, fatigue, and prolonged abstinence.

71. *B. Of the extrinsic influences or agents*, which tend not merely to predispose the system to the action of the specific cause of hæmagastric pestilence, but also to aid in developing the effects of this cause, *warm, humid, and stagnant states of the atmosphere* are the most remarkable. This pestilence has generally prevailed during high ranges of temperature, and at that season, and in those localities, in which considerable humidity was associated with warmth; and these with a still or calm state of the air, or with crowded habitations and imperfect ventilation. Such has more particularly been the case when this distemper has become epidemic in countries without the tropics. Within the tropics all sheltered situations near the level of the sea, or near the sea-coast, present at all seasons the conditions, in respect of warmth or of humidity, requisite to the epidemic prevalence of the malady. Still, although these conditions are required for the development and dissemination of the infection, they are not either individually or conjointly capable of producing the distemper, without the operation of the specific exciting cause. They are merely the atmospheric conditions required to give the infectious germ activity.

72. The *seasons* which are characterized by a high range of temperature and much humidity, as summer and autumn, are those in which this pestilence has become prevalent in temperate climates, when the infection has been imported or conveyed thither. A low range of temperature and dryness of the air, although attended by much heat, have been found, on the other hand, to check the propagation of the distemper, and even to prevent its development. When the infectious seminium has been introduced in a crowded locality during degrees of atmospheric warmth and humidity favourable to the evolution and propagation of its effects, and when the consequent epidemic has become very general, the distemper often continues to rage, although the temperature of the season has fallen much below that observed during its outbreak, or even below that which is believed requisite to its development. This has been remarked in respect of epidemic visitations of the pestilence, both in Spain and in the United States. That unusually high ranges of temperature have no influence alone in producing the malady, may be inferred from the facts observed in connexion with the prevalence of it, both in hot and temperate climates; for the periods of its appearance in the one, and the seasons of its occurrence in the other, have not been always, or even generally, characterized by unusual warmth. Indeed, a careful perusal of facts connected with the outbreak of the distemper in Africa, the West Indies, in Spain, and in America, fully convinces me that excessive warmth is not concerned in its production more than a somewhat lower grade, a high degree of heat, as I have just stated, being only one of the conditions requisite to its prevalence, but then the presence of the efficient agent—the infectious seminium—is indispensable: this is the seed; warmth and humidity are merely the conditions of the soil requisite to its germination; and although the former may lie dormant for a time until the latter give it activity, still it is not less the efficient, the specific, and the undoubted cause of the pestilence.

73. *C. Infection.*—According to the definition I have given of this term in the article INFECTION, there can be no doubt in the mind of the unprejudiced, after a due examination of

the evidence respecting it, as to the dissemination of this pestilence by infection. My limits will not permit me to detail, circumstantially, or even fully, all the facts which have been adduced by most respectable authorities, proving the propagation of this malady by infectious emanations proceeding from the affected, but I shall adduce sufficient evidence to show that the true hæmagastric pestilence spreads in this manner, and that the evidence of its infectious nature is similar to that by which the infectious nature of scarlet fever or smallpox is proved and admitted. But smallpox, scarlet fever, and some other infectious diseases, are among the most common maladies in our climate, and can no longer be prevented by measures in any way tending to embarrass traffic and mercantile speculation, while this pestilence, plague, and pestilential cholera are foreign to this and most European countries, and the only modes of preventing their extension to these countries hitherto attempted have been such as more or less hamper commercial undertakings at certain seasons and with some foreign parts. It cannot be denied by any one who has attended to the subject of quarantine, especially as it has been agitated in recent times, and with a due knowledge of the influence which the ruling passion—the desire of amassing wealth—exerts upon all the more generous and social emotions of the mind, that the restrictions imposed upon trade, arising out of precautions against the introduction of pestilential infections, have been the chief causes, directly or indirectly, producing the opposition to the doctrine of the infectious properties of pestilence; and that all that has been written to disprove this doctrine—and written with no small virulence by some—has not proceeded from a firm conviction of the justice of the cause espoused, but are either special pleadings subservient to sordid purposes, and to the gratification of disappointed feelings or of private resentments, or the outpourings of minds teeming with mistaken views, arising out of imperfect observation and hastily-formed opinions, and excited by a desire of acquiring notoriety in a contest involving the interests of the whole community.

74. Let any one altogether unprejudiced as to the infectious or contagious properties of pestilential maladies, attentively peruse most of what has been written respecting them in this and in other countries, carefully examine the evidence adduced before committees of the House of Commons, or in other places, and critically weigh the import and truth of the conclusions arrived at by commissions sent to investigate facts on the spots of their occurrence, and the various circumstances connected with the facts adduced—let any one who possesses sound common sense, with some share of science, but who is at the same time entirely free from the undue influences of prejudice, of temper, and of interest, inquire into the matter—and I cannot believe that he can arrive at a different conclusion from that to which I have arrived, after the best attention I have been able to bestow upon this most important and much-discussed subject. Whoever may enter upon this very unpleasant investigation with these moderate qualifications, which, however necessary, are quite sufficient to the formation of just conclusions respecting it, will be surprised to find that, among members of a learned profession, so much ignorance should be displayed in the literary character of some of these writings, in the scientific and professional execution of others, and in the illogical inferences of many of them. The duly qualified and candid investigator will detect statements made without proof, facts assumed without evidence, and supposititious agents believed in as real existences, and these made the bases of reasonings altogether inconclusive even as regards the conduct of the argument. He will find things, facts, and diseases dissimilar from one another, and presenting no connexion either as to nature or to sequence, viewed as identical with each other. He will detect the suppression of important facts and circumstances, and an undue prominence given to others of a doubtful character. He will remark the imputation of motives which did not exist, and ignorance of those which influenced, if they did not impel the writers. He will observe the precipitancy with which the young, the inexperienced, and the ignorant have rushed into print, and attacked, with disgusting flippancy and intemperance, much abler and better-informed writers. In every medical periodical existing during the late war, he will find accounts of a disease never seen by the describers, their own mistakes proceeding from profound ignorance of the name and nature of the malady seen by them, serving as the basis of their lucubrations and of their arguments. And he will, moreover, be grieved to remark the opinions of learned and experienced men either misrepresented or impugned in jejune and paltry performances, evincing a most remarkable ignorance of the language in which they are written, and a still greater ignorance of that from which they profusely and inappropriately quote. In thus attempting to reach the pure spring of truth at the bottom of the deep well of research, he will have to penetrate not only through the rubbish thrown in by unfaithful, by mistaken, and by ignorant inquirers, but also through the accumulated filth of uncandid and intemperate controversy.

[We stated, under the article "Infection" (p. 405, vol. ii.), that the weight of medical opinion in this country is opposed to the doctrine of Mr. Copland, that yellow fever owes its spread to a specific infection of an impalpable nature, emanating from the bodies of those already infected. It may, after all, appear that the controversy in relation to the mode in which yellow fever is propagated is merely one about words; that it originates in not agreeing upon the meaning of the terms employed; and that, if these were logically defined, and then used only in the sense of the definition, there would really be found to be no difference of opinion in the profession, but, on the contrary, entire harmony. It is very evident that Dr. Copland uses the terms infection and contagion in a sense different from that in which they are employed by American medical writers, making, as he does, the former a generic term, and contagion merely one of the modes in which it takes place. Now, if we understand by a contagious disease, one which is communicated under any circumstances of atmosphere, whether pure or impure, by contact or otherwise, as

smallpox, measles, hooping-cough, &c.; and by an infectious disease, one whose communication depends on an impure or vitiated state of the air, there would be perfect unanimity of opinion as to what category yellow fever would properly belong: no one would think of calling it a contagious disease; but, like plague, cholera, and typhus fever, it would at once be ranked under infectious maladies. If these diseases are ever communicated in a pure atmosphere, it is only an exception to a general rule, and, as such, should not be considered a valid objection to such distinction, *exceptio probat regulam*. Let it then be admitted that yellow fever is propagated, or, if you please, communicated through an impure atmosphere only, whether it be by a process analogous to fermentation or assimilation it matters not, yet, if the above distinctions are followed, the disease should be called an *infectious*, not a *contagious* one. In using this latter term we unnecessarily open a wide door to controversy, and become involved in discussions merely about words. But if we give that latitude to the meaning of the terms employed, as indicated by our author, we are at once involved in an endless sea of controversy, without a pilot or a helm. As then, after all, there is not that difference of sentiment which is generally supposed on this subject, it being rather apparent than real, we regret to notice the severity of language employed by Mr. COPLAND toward those who seem to differ from him in relation to this matter. We do not believe that there is any good reason for impeaching the motives or doubting the sincerity and honesty of those who have expressed opinions apparently at variance with those of our author; we shall regret to find that the example here set, of vituperating those who seem to differ with us in opinion, finds many imitators in the profession.]

75. *a. The history* of the various manifestations of this pestilence conveys to the experienced physician a certain degree of evidence as to their infectious characters, although the circumstances connected with them have been very imperfectly recorded. The earliest notice of the appearance of the hæmagastric pestilence in the West Indies is made by LIGON, in his "History of Barhadoes." He states that it broke out early in September, 1647, and that, before the expiration of a month, the living were hardly able to bury the dead. After the year 1647, no mention is made of this malady until 1686, when it was said to have been imported to Martinique from Siam, and was then called the "*Maladie de Siam*." M. DESPORTES, who practiced during many years in St. Domingo, says that it appeared in Martinique in consequence of a large fleet from Siam which arrived there with a "malignant or pestilential fever, of which a great number of the sailors perished;" and several French writers state that, having been communicated to the inhabitants of Martinique, it was afterward carried to St. Domingo. Captain PHILLIPS states that this malady prevailed in Barbadoes in 1694; and Mr. HUGHES, on the authority of Dr. GAMBLE, mentions the prevalence and fatality of it in 1695; and the circumstance of its being called the *new distemper*, or *Kendal's fever*. Dr. TRAPHAM, in a work on the health of Jamaica in 1679, says, that "about eight years since, when the victorious fleet, returned from the signal Panama expedition, they then brought with them a high, if not pestilential fever, of which many died throughout the country; but this being a foreign distemper brought from abroad, the causes of which I could not so well jugde of, but conclude Jamaica more happy than to be annoyed therewith, directly and originally" (p. 81).

[Dr. DOWLER, of New Orleans, remarks, that "Mr. WEBSTER, who has collated the various authorities in relation to the origin of yellow fever in America, shows, in his work on Pestilence, that when the whites arrived in New England, in 1620, some of the Indian tribes had been reduced from 30,000 to 300, two years previously. The survivors asserted that the sick bled from the nose, and turned yellow, like a garment of that colour, which they pointed out as an illustration. Their statement as to the great mortality which the malady caused was fully confirmed by the number of recent, unburied skeletons strewed about their towns.

"This author, at a later period, after more thorough investigation, reiterates the statement, 'that a pestilential yellow fever prevailed among the nations of New-England, about two years before the settlement made by the English, is a fact as well attested as any historical fact on record.'

"The settlement of Virginia preceded that of New-England. Some of the colonists in the former, before those of the latter arrived, had witnessed the almost entire destruction of many Indian towns by an epidemic, which, though vaguely called the plague, was probably the yellow fever. No diagnostic criteria have been transmitted to our times by which this conjecture can be satisfactorily decided. With respect to the New-England epidemic alluded to, the case is different; three of the most salient characteristics of yellow fever, viz., great fatality, yellowness of the skin, and hemorrhages, are enumerated distinctly. There is nothing improbable in admitting this statement, fatal as it may be to the doctrine of imported contagion. The Indians, even the Southern Indians, are, as I know from personal observation, sometimes the victims of yellow fever, when recently from rural situations. It is almost certain that the native Indians of the South, constantly resident in large towns, would be little, if at all, liable to this disease, while the same description of persons in northern towns would, like the whites of the North, enjoy no such protection. The localities which develop yellow fever are urban, not rural. Hunting and war, the elements of savage life, are but little favourable to a dense town population. Hence, savages seldom suffer from this disease. It cannot, however, he denied that very small towns are liable to suffer.

"The infrequency of yellow fever among the savages of America cannot be inferred from the silence of authors on the subject, with but few exceptions, for nearly two centuries. The difficulty of getting information from them in relation to their maladies will, in a great measure, furnish a sufficient explanation.

"In 1746 the Mohegan trihe was wasted by this malady, which began with pain in the head and back, followed by fever, and on the third or

fourth day with intense yellowness of the skin, black vomiting, and bleeding from the nose and mouth. This fever commenced in August and ended with the approach of cold weather. Albany, in New-York, was at the same time the theatre of a similar visitation, as was the Seneca nation of Indians the year before. If the circumstances of savage life were equally favourable to the production of yellow fever as those of civilized life, still, however, the difficulty of obtaining from hostile savages any authentic information in relation to it will explain one of the causes which have clouded its early history among the nations of North and South America, together with those of the islands washed by the Caribbean Sea and the Gulf of Mexico."]

76. Don Ulloa affirms that this pestilence was unknown at Carthagena and Porto Bello before the year 1729. Medical literature furnishes very few instances of the appearance of this pestilence in the West Indies during the eighteenth century, until the dreadful outbreak in 1793. Still we are not to infer that occasional visitations of it did not take place, although no published record of them exists; indeed, imperfect notices of such visitations are to be met with in several works; still they appear to be few and far between, and evidently prove that they have not been the results of endemic causes, or of circumstances connected with locality or season, and to have been altogether different from the maladies arising out of these causes and circumstances.

77. Dr. Currie, in his work on Bilious Fever, states that "a contagious fever, called the yellow fever, has occurred at Philadelphia six times since the first settlement of the city; viz., in the years 1699, 1741, 1747, 1762, 1793, and 1797." Gough, in his history of the Society of Friends, says, "that the fever which prevailed in 1699 had, for a considerable time before, been very mortal in the West India Islands." Dr. Lind states that, in the year 1741, "the disease was introduced by means of a trunk of wearing apparel received from Barbadoes, which had belonged to a gentleman that died of it in that place; and that the disease spread from the family that received the trunk into the town, and destroyed above two hundred of the inhabitants." Mr. Lardner, mentioning its prevalence in 1747, adds, "that many, whose business and families would permit them, fled from the city." In an account of the prevalence of this pestilence in 1762, communicated to the College of Physicians by Dr. Redman, it is stated that the disease was introduced about the end of August by a mariner, who arrived from the Havana ill of it, and took lodgings near the new market, below Pine-street. It was confined principally to the vicinity of the new market and the street west of it, spreading gradually from one family to another, till toward the end of September."

78. Dr. Lining, of Charleston, has described this distemper in a letter to Dr. White, and given the following account of its appearance in that city up to the period at which he wrote: "This fever does not seem to take its origin from any particular condition of the atmosphere, independent of infectious miasmata; for within these twenty-five years, it has been only four times epidemical in this town, viz., in the years 1732, 39, 45, 48, though none of those years (excepting that of 1739, whose summer and autumn were remarkably rainy) were either warmer or more rainy (and, some of them, less so) than the summers and autums were in several other years, in which we had not one instance of any person being seized with this fever. But that this is really an infectious disease seems plain, not only from this, that almost all the nurses caught it and died of it, but likewise, as soon as it appeared in town, it soon invaded new-comers, *those who never had the disease before*, and country people when they came to town, while those who remained in the country escaped it, as likewise those *who formerly felt its dire effects*, although they walked about the town, visited the sick in all the different stadia of the disease, and attended the funerals of those who died of it. And, lastly, whenever the disease appeared here, it was easily traced to some person who had lately arrived from the West Indies, where it was epidemical." (*Essays, Phys. and Lit.*, &c., vol. ii., p. 370.) Dr. Warren gives similar testimony to that now stated by Dr. Lining respecting this pestilence as it occurred in Barbadoes and adjoining islands during the early part of the last century. (*See Treat. on the Malignant Fever in Barbadoes and neighbouring Islands*, &c., *by* H. Warren, M.D., 8vo. Lond., 1740.)

79. Although this pestilence has frequently broken out in the West Indies and in several of the seaports of the United States during the last century, still considerable intervals, especially as regards individual towns and localities, intervened between its appearance. De La Fosse makes no mention of its occurrence in St. Domingo between the years 1775 and 1785. Dr. Chisholm asserts that no contagious fever, nor any epidemic of the character of this pestilence, appeared in Grenada from the year 1763 until 1793; and Dr. Gilpin, who resided many years in this island previous to 1793, confirms his assertion.

80. That the West Indies were not very unhealthy for many years previously to 1793, is shown by the testimony of Dr. Davidson, who, in a letter to Dr. Mease, of Philadelphia, states that, in the more healthy islands of St. Kitts, St. Vincent, and Barbadoes, soldiers have arrived from Europe and remained there for years in the enjoyment of good health, notwithstanding their debaucheries. And Dr. Weir, director-general of army hospital, states "that he arrived in Jamaica in 1785, from which time till 1792 only one officer died out of four regiments quartered in that island; that the troops were in general healthy; that although fevers were frequent, they were not fatal," and that no fever of a bad type occurred during these years, until 1793, when this pestilence appeared. Dr. Theodore Gordon served in Barbadoes, Dominica, and Jamaica during five years preceding the occurrence of this malady in 1793, and considered the health of the troops remarkably good, the chief diseases being remitting and intermitting fevers, dysentery, and affections of the liver. That this malady is not a constant resident in the West Indies, although frequently appearing there, is farther shown by Dr. J. Hunter, Dr. Franklin, Dr. Gordon, and others, who have found troops remain during several years remarkably healthy; and

yet, in the most healthy seasons and localities, this malady has occurred and swept off many hundreds in a very short period. Its outbreak in these islands, after many years of immunity from it, occurred in February, 1793, in Grenada, at a time when bilious remittent fever does not prevail; at which time, also, and for a considerable period afterward, all the other islands continued healthy. But after the appearance of this pestilence, every station, however healthy before, suffered severely from the contagion. It did not reach Dominica until the end of July. Barbadoes was unaffected until the beginning of 1794; and St. Domingo did not suffer from it until late in this year; and then in consequence of the introduction of the contagion by a detachment of troops from the island of Guadaloupe, where it was raging. This pestilence appeared in Philadelphia in the month of July, 1793, and during the latter part of that year and 1794 it reached most of the West India islands.

81. The reappearance of this malady in the West Indies, after an immunity from it during many years, was attended by many distressing results, owing to the circumstance of its having been confounded, by superficial and inexperienced observers, with the common remittent fever of the country. We frequently find, upon referring to reports of medical officers, that the pestilence broke out and was most destructive among regiments which had marched into barracks in which it had already prevailed. Thus the 35th regiment landed in Guadaloupe on the 12th of May, 1795, and on the 30th of June of the same year, in six weeks, it had lost 136 men. The 2d regiment landed at Martinique in March, 1805, and in the following May it had lost 97 men. These men landed during the prevalence of this pestilence in these islands, and, without any exposure, they instantly, and without marching or service, occupied quarters in which this malady had prevailed; but, as it was supposed not to have been infectious, the highly-predisposed troops were instantly introduced to the operation of its efficient cause. The distemper was viewed as having been free from infectious properties, and as being the common seasoning fever of the climate, and no precautions were taken, in these instances as well as in many others, against its dissemination. Numerous other instances might be adduced of the dreadful effects resulting from monstrous ignorance on the part of those who ought to have been informed by the experience and judgment of those who had gone before them, if they were incapable of arriving at rational inferences by their own unassisted reason; but the subject is humiliating to human nature, especially when viewed with reference to medical doctrine and to professional character. In those days, and even down to the present day, the arrival of Europeans within the tropics was generally inferred to produce what was called a *seasoning fever*—a name imposed upon all fevers, however occurring, within the first twelve or eighteen months after the change of climate—a name, moreover, applied very frequently to conceal ignorance, or even to mislead. But fever solely depending upon change of climate merely, irrespective of infectious or other miasms, is neither so immediate in its invasion of new comers, nor so rapid in its course, nor so malignant, nor so fatal, as the pestilence now under consideration. In this I speak from observation in two quarters of the globe. But to proceed with the evidence as to the infectious nature of this distemper.

82. Dr. J. Stuart, who practiced during many years in the island of Grenada, both before and after the prevalence of the pestilence in that island in the years 1793, 1794, and 1795, states, in a letter to Dr. Chisholm, "As to the character of this fever, my experience has fully satisfied me that it was specifically distinct from every form of the indigenous bilious remittent which I had ever observed, because it appeared at a season of the year which I had always found healthy during a period of nineteen years' residence in the colony; because it did not appear particularly in those situations where bilious remittent fever usually prevailed during the unhealthy season of the year; because there was an evident difference in the character and type of the two diseases; because I never knew this fever terminate in intermittent, as remittent or bilious fever commonly does; and because I did not find the same mode of treatment successful in both kinds of fever." Dr. Stuart goes on to remark, "that a thorough belief existed in the minds of all the medical gentlemen in Grenada that the malady was infectious," one only, and he merely *at first*, doubting this property; that he himself and several other medical men contracted the disease in their attendance on the sick; and "that the malady, in his decided opinion, was propagated by visiting infected apartments, or by the near approach to, or contact of, people labouring under it." (*See* Dr. Chisholm's *Letter to* Dr. Haygarth, p. 24.) Dr. Gordon, of St. Croix, government physician to the Danish West India Islands, concludes his remarks on the malignant pestilential fever prevalent in these islands and in North America near the close of the last century, by stating his belief in the importation and diffusion of infection, "by ignorance, perversity, selfishness, or the abstraction of the sentiment of public good; by the abuse of all preventive measures in the promotion of the speculations of cupidity and the calculations of venal men; by the prostration of truth and humanity, and the eluding the laws of quarantine."

83. Dr. Dancer, of Jamaica, after a close examination of the opinion emitted respecting the malignant pestilence of 1793–6, states most decidedly "that it is an imported disease, and is communicable by contagion." He adds, "that it has no apparent connexion with local causes; that it has appeared in the healthiest seasons and localities, and has prevailed least in unhealthy and marshy places."

84. *b.* Dr. Charlton, president of the Medical Society of New-York, states, in a letter to Dr. Hosack, of the 9th of September, 1803, "I have practiced physic in this city since the year 1762. The fevers that have usually occurred in summer and autumn during this period were intermittent, bilious remittent, and nervous or typhous fevers. I never saw a case of yellow fever in the course of my practice before the year 1793." He adds, that he always considered the yellow fever as "a disease of foreign origin;" and that he "never met with a case of it in the country but which could be clearly traced to infection from the city."

85. Dr. S. Bard, who commenced practice in New-York in 1766, remarks that, although he observed hospital and jail fevers there during the revolutionary war, he never saw a case of true yellow fever until 1795; that he considers it a distinct idiopathic disease, and not a variety or grade of any other; and that he believes it to have been an imported malady. Dr. Hosack states that Dr. Ledyard at first believed this pestilence, as it appeared at New-York, was generated in the place; but subsequently had reason to change his belief, as all his observations at the health office satisfied him that it was exclusively derived from the West Indies (p. 32).*

86. It has been supposed that the fatal prevalence of the pestilence chiefly in cities, towns, and localities near the level or on the margin of the ocean is a proof of its origin in such situations, and that it does not admit of appearing at any considerable distance from these places; but that it would frequently be propagated through inland districts if the malady possessed infectious properties. The truth, however, is, that it has not unfrequently been conveyed to places around, and inland, from the sea-ports where it broke out and prevailed in Africa, America, and the south and east of Spain. Dr. Stratton met with numerous instances of the propagation of the pestilence, when it appeared at Philadelphia in 1797 and 1798, to persons residing at considerable distances, and who had not visited the locality in which it prevailed. Thus he states that twenty-seven persons had retired from Philadelphia and Washington with the disease, and fifteen received the infection by communicating with them. "One young lady fled from Wilmington into New Jersey, was attacked about a week after, and communicated the malady to her uncle, her nurse, and a young man who visited her. Two of the four died." And he adds, "there have been many instances of the pestilence being brought from Philadelphia to Jersey, and of its being communicated from the persons thus infected to others; and, if it may be thus conveyed from the former to the latter, I see no difficulty in supposing that it may be brought from some other place to Philadelphia."

87. The College of Physicians of Philadelphia, in 1798, came to the following conclusions: "1st. That the pestilential yellow fever lately prevailing in that city differs essentially from every other disease which is common to North America, and agrees in its most essential symptoms with what is called the yellow fever in the West Indies. 2d. That it has been regularly traced to the vicinity of some vessel or vessels from the West Indies, or to persons or clothing connected with them. 3d. That the principal peculiarities of this fever are its contagious nature, the progress of the symptoms, and the mortality consequent on it. 4th. That to prove the contagious nature of this disease would be equally useless as to prove the contagion of the plague. 5th. That, in all their observation and practice, they know of no case where the autumnal bilious remittents of the country have proved contagious. 6th. That, although these are sometimes attended by violent and dangerous symptoms, this striking characteristic of contagion being always absent, they never become an object of public dread or concern." Preceding these conclusions, these physicians put the following pertinent questions: "Where do we see the first appearance of this pestilential fever? Is it among the marshes to the southward of our city, or in the neighbourhood of our wharfs? Is it in the confined alleys, or on the salubrious banks of the Delaware at Kensington? Is it not always near those places where vessels from foreign countries are found? Do the fevers common to the country steal on insensibly, infecting one person after another in a family and in a neighbourhood? Are they equally severe in seasons so opposite as in 1797 and 1798?" They likewise remark, "that very erroneous opinions have arisen from confounding this pestilential fever with the malignant remittents of the West Indies and America;" and they further subjoin proofs of the importation of the infection in 1798.

88. Dr. Bancroft insinuates that Sir W. Pym had formed his ideas as to this pestilence from the accounts furnished by Dr. Chisholm, of its introduction into Grenada. Sir W. Pym, however, witnessed its appearance in Martinique in 1794, before he had even heard of Dr. Chisholm; and his extensive experience of it in the West Indies fully confirmed this physician's account of it. Indeed, when Dr. Bancroft first wrote upon this distemper, it is even doubtful whether or not he had ever encountered it, or seen any other fever than the remittents of warm climates, which he had confounded with it; at any rate, his experience of it was very limited. Sir W. Pym's account of his experience of this pestilence, both in his own person and in the several armies and expeditions with which he served in the West Indies, conveys the strongest internal evidence of his thorough knowledge of the origin and nature of it. Of his later experience in Spain and the Mediterranean, and of the successful measures which were on several occasions adopted in order to extinguish this calamity, it is unnecessary here to speak, as they will partly appear in the sequel.

89. Sir W. Pym distinctly states that, when this malady broke out in the islands where he served, in 1794 and 1795, other physicians, both English and French, considered it distinct from the endemic of the country. He mentions, respecting one of these isles, that it originated in three companies of the 70th regiment, quartered in bomb-proof barracks, and extended from them to men in hospital with other complaints, and, in succession, to the surgeon and hospital attendants. It next invaded the troops quartered in more elevated situations in the same fortification; while the only persons in the town of Fort Royal that suffered from the distemper were officers who had joined the mess or visited the sick officers of the 70th regiment. Sir W. Pym advised the

[* The statistics of our quarantine establishment at Staten Island have an important bearing on the subject of the infectious character of yellow fever. From the year 1806 to 1844 inclusive, there were 101 arrivals of sickly vessels at quarantine, that is, of vessels on board of which there had been one or more cases of the fever. 155 cases of the disease were introduced from these vessels into the hospital, and 174 sailors or passengers sickened after their arrival. Of those who communicated with the vessels from on shore, 31 sickened, and five only who had no communication with them. Of the total number, 329, 179 were cured, and 150 died.]

men to he encamped on an elevated and airy place at a distance from the town; and in a few days the malady disappeared from the camp, and the regiment continued free from it until the arrival of convalescents from the hospital with their blankets and knapsacks, which, having been distributed among the different companies, communicated the pestilence so very generally that, in a very short time, none escaped it but those officers who either had it very slightly, or had resided some years in the West Indies.

90. This was the first regiment which had suffered from this distemper in that campaign; but the infliction was viewed as a seasoning fever by some; as the endemic of the country, aggravated by fatigue, by others; as the result of malaria, or of any thing else under the sun, excepting what it really was, hy many. The few who entertained correct views were disregarded, and were not in positions to procure attention from ignorant superiors, and the results were exactly what might have been anticipated. The distemper extended, "and soon ran through every corps that had arrived from England, and even through the regiments that had been some years in the West Indies; with this difference, that the last-mentioned suffered a smaller mortality." Nevertheless, the total loss of the army, in the course of a few months, was not less than 6000 men. "The inhabitants, also, suffered severely; but the mortality was small among the natives and those long resident in the island; but the newly-arrived, sea-faring persons, and men belonging to transports, suffered in as great a proportion as the military." He adds, that people of colour also suffered from fevers, but in a much slighter degree, and less dangerous form. "During 1794 and 1795, re-enforcements continued to arrive, and, from occupying the same barracks and quarters with the troops which had suffered from the disease, the contagion was frequently communicated to them immediately upon their arrival, and there were many instances of officers and men not surviving a week after debarkation."

91. The opinions of several physicians are adduced by Dr. Bancroft in favour of the non-infectious nature of this pestilence; but, upon referring to them, it will be found that they actually support a very opposite doctrine; and that their ideas, as to a non-infectious character, had reference entirely to the remittent endemics of which they were treating, and not to epidemic yellow fever—a piece of sophistry of the most dishonest and contemptible kind. Thus Dr. Gillespie, who is thus misrepresented by this author, and adduced by him as an evidence against infection, states that "infection could in many instances be traced, and appeared to operate as well through the medium of terror as that of the *effluvia emitted from the bedding and persons of the patients.* Of this a melancholy instance happened in an armed sloop, into which a draft of about fifty men had been judiciously sent to cruise, and thereby to be preserved from sickness; but the *contagion having been carried on board* previously to her sailing, and being destitute of medical aid, the men were attacked in succession, and three fourths of them died;" while in other armed vessels in which similar drafts had been sent with the same intention, the people continued in good health. Dr. Pascalis, who is also quoted by Dr. Bancroft in favour of non-contagion, states as follows: "It has appeared to me, as well as to many practitioners, that a considerable number of the cases could not be traced *but to a contagious power of the fever itself:* such were the cases of whole families, who seemed preserved as long as they had no patient in their houses, and who all perished or were sick, without exception, as soon as they admitted among them any one affected with the disease. This deplorable effect has been seen in the most wholesome parts of the town (Philadelphia), and at any period of the season; so that, in many instances, where the disease seemed most universal, hy care and precaution, people were preserved; while in the country they fell victims to their unreserved intercourse with patients when the epidemic was fast decreasing in every part of the town." Dr. Lempriere, another of Dr. Bancroft's authorities, testifies, in opposition to the special pleadings of this writer, that "he could not admit a douht in his own mind of the disease being of a contagious nature;" and M. Gilbert adds, that "he cannot deny that the malady may he communicated by the expired air, or by the contact of matters impregnated by the miasms exhaled from those affected."

92. Of the several outbreaks of this pestilence in the United States, it is unnecessary to state more than has been already advanced, especially as the details connected with one of them are in every respect similar to those of the rest, as well as to those connected with the appearance of the distemper in Europe. The localities in which the malady first broke out in North America have been viewed as the sources from which it emanated, independently of importation or infection, hy those who argue against this property, and who consequently consider it incapable of being thus propagated or imported; and, however small the grounds furnished them for believing that these localities were or are capable of furnishing the exhalations, miasmatous or terrestrial, or however denominated, still they contended that it acknowledged this and no other source—that it was propagated by the air of the locality, contaminated by exhalations from the soil and matters covering or existing in that soil, and not hy emanations proceeding directly from the bodies of the sick, or imbibed by substances capable of retaining them for a time and afterward imparting them to the surrounding air. That the distemper, however, appeared in various places in that country where no evidence of terrestrial exhalation could be produced, and even where the presumption of such having ever existed seemed absurd, unless, indeed, it can be credited that a specific flatus or gaseous poison may be exhaled at certain particular parts of the earth's surface, without affecting the senses in a perceptible manner, or all who may be within its sphere, and produce a certain specific effect, identical in every respect, on all occasions, and in all quarters of the globe. However gross and absurd this assumption may appear, it actually forms the base upon which the non-infectionists found their doctrine. If the truth of this doctrine be for a moment conceded, it necessarily follows

that this terrestrial exhalation or poison may proceed from any situation, soil, or place, without reference to physical condition or geological formation, seeing that its specific effects have appeared in all kinds of locality whenever the range of temperature favoured their evolution. The yellow, or hæmagastric, fever broke out in September, 1811, at Perth Amboy, in New Jersey, U. S., a town and surrounding country presenting none of the endemic sources of disease, but holding frequent communication with the West Indies. On this occasion, the Board of Health at New-York, consisting of several of the most eminent men and physicians of that city, recommended the mayor to issue his proclamation interdicting all communication between the city of Amboy and the city of New-York; and to appoint a committee to inquire respecting the malignant and infectious fever which had appeared in the former city. Dr. Manning, physician in Amboy, reported to the committee that it was the pestilential yellow fever; that "there was but one opinion with either the inhabitants or physicians as to its origin, namely, that it was derived from some of the West India vessels which had been lying at the wharfs; and that the brig Ocean, from St. Bartholomew's, and the ship Favourite, from the Havana, lying alongside of the Ocean, were generally supposed by the inhabitants to have introduced it." He stated that there were no local causes to which this calamity could possibly be referred; that the city is very elevated; the soil chiefly composed of sand; free from all lodgments of water; the streets wide; and the houses for the most part spacious; and that the whole town exhibited an uncommon degree of cleanliness. He further reported that the citizens were so perfectly convinced that the fever was imported in the vessels at the wharfs, that they were removed to the stream; and that the persons first attacked were frequently on board of the vessels above named. The committee, after visiting Amboy, reported, "that other persons taken ill had been exposed either directly by being on board the vessels, or by visiting those who were ill of the disease." About this time, also, the Board of Health of Philadelphia issued a proclamation, prohibiting all communication between Amboy and the city and county of Philadelphia, on account of a pestilential disease prevailing in the former city, and imposing a quarantine of fourteen days on all persons after leaving Amboy, before they could be admitted into Philadelphia.

[In 1820, Dr. Beck, of this city, was sent by the Board of Health of New-York to Middletown, Conn., to investigate the nature and origin of a malignant fever which had prevailed in that place to some extent, and which was reputed to be yellow fever. Dr. Beck reports that thirteen cases had occurred in that city, seven of which proved fatal. The disease was pronounced to be unequivocal yellow fever, and to have been introduced by the brig Sea Island, from the West Indies, on board of which three persons had died of the disease. Dr. B. states that, in his opinion, the existence of the disease was owing to the presence of this vessel. (*Hosack's Med. Essays*, vol. ii., p. 61.)]

93. *c.* Of the earlier occurrences of this pestilence in the *south of Europe*, but imperfect information has been furnished. It appeared in Lisbon in 1723, black vomitings being the most prevailing and fatal symptom. Dr. Kennedy, physician to the English factory there, states "that it was very contagious in the lower parts of the city, going through a family, and very few families escaping," especially in the ill-ventilated streets. It showed itself at Cadiz in 1764, and did not again appear in that city until 1800. A vessel arrived there in August of that year from the West Indies, and on board of her some persons had died of the yellow fever on the passage. After her arrival at Cadiz, the whole crew, passengers, and pilot were landed, and died of the disease. The infection rapidly spread throughout the city, and extended to several neighbouring and inland towns.

94. This pestilence appeared at Malaga* in 1803. The governor of that city informed his relative, the consul-general of Spain in London, that it was brought there by a French ship from the West Indies. After disappearing during the winter, it reappeared in the following summer. In this year, 1804, it spread from Gibraltar to Cadiz, and to several parts of the Mediterranean, to Leghorn and St. Lucar. Sir W. Pym, then superintendent of quarantine at Gibraltar, met with one case of the distemper in this fortress in 1803; and, as Dr. Hennen remarks, this may not have been the only case; for many attempts were made to impose upon the authorities and keep them in ignorance, and the malady was at that time prevailing at Cadiz and Malaga, cities not far removed from Gibraltar.†

* The introduction of the pestilence into Malaga in 1803 is stated by Dr. Arejula to have commenced in the house of C. Verduras, a noted smuggler, who had brought from one of the vessels in the bay, and secretly conveyed to his house, a person labouring under a disease of which he soon afterward died. It was subsequently discovered that the body was privately buried in the adjoining church of St. Peter. On the 26th of August, and next three days, the son of the smuggler and two other men, associates of his, were attacked, and two died. Soon after the death of the son, on the 3d of September, his mother and two sisters sickened with the same symptoms, according to the report of the physician. Verduras the father died on the 15th of September, and his daughter and another son, who also had been attacked, died on the 19th. While the distemper was thus running through this family, persons adjoining and friends of the family were seized, the malady spreading gradually from this house and locality. Dr. Arejula states that the person who was secretly landed and died in Verduras's house was buried by and with the connivance of the curate, who was himself taken ill a few days afterward, and died, together with the physician who attended him; "and in like manner, every person connected with the curate's family was taken ill and died; even the sacristan and his wife, as well as the boy who attended the priest at the altar." Those, also, who entered the Church of St. Peter, where this person was buried, to hear mass on St. Michael's day, were all taken ill, and a great part of them died. This church was, therefore, shut up, and continued closed until December, 1805, when Dr. Arejula entered it, and directed the fumigation of it. The account furnished by this physician was confirmed by the researches of Sir J. Fellowes, who obtained the same information as he had obtained, and traced the distemper to the same source.

† The facts connected with the introduction of the pestilence into Gibraltar in 1804 are thus stated by Sir James Fellowes: "From the confession of *Santos*, the person first attacked, and from the oath of a respectable witness, it appeared that *Santos* had recently left an infected house at Cadiz; that he had been three times in company with a person actually labouring under the disease on the 23d and 24th of August; that he arrived at Gibraltar on the 25th, was taken ill on the 26th, and was seen by a French practitioner, Mr. Jarg, on the 27th, and that in less than eight days after his being attacked, his mother, two aunts, one

95. The deaths among the military and their families during the two preceding years were 35 in 1802, and 56 in 1803; but in the last four months of 1804 the deaths were as follow, from this pestilence: Officers, 54; soldiers, 864; soldiers' wives and children, 164; civilians, 4864; being altogether 5949. Dr. Nooth and several surgeons, both military and naval, believed that this pestilence, which had thus in four months carried off nearly half the population, to have been local as to origin, and non-infectious; while Sir W. Pym and Sir J. Fellowes, and the surgeon of the artillery, gave their decided opinions that it was highly infectious, and that it had been introduced from abroad. But the scientific and experienced reader—especially if he have ever seen cases of this pestilence—will be much surprised, and at once know how to estimate Dr. Nooth's opinions on these topics, when he reads in that physician's first official report that he considered the fever "as decidedly inflammatory as it possibly could be;" that he believed many of the medical officers to have lost their senses for believing the malady contagious and of a putrid character; that he laboured to convince the public that there was nothing to be dreaded from a communication with the sick; and that he (evidently then a stranger to the malady!) dictated peremptorily to the medical officers below him (for, most unfortunately for thousands, he was at the head of the medical department) the mode of treatment they ought to pursue. In his *second* official report something of the results of these hastily-formed opinions and measures becomes apparent; for he states the losses in certain corps to have been "enormous," and, among the inhabitants, the ravages of the distemper "as beyond description terrible." He, moreover, now begins to waver as to the source of the malady, and either gives very opposite opinions, or is altogether ignorant of the meaning of the terms which he employs. Thus, after stating that he had himself "contracted the fever in that *focus of contagion*," he adds that "the disease by no means seems to be *infectious*, but the whole atmosphere on the rock is *pestiferous;* and I am inclined to think that, in addition to the ordinary causes of *contagion*, we may consider a large *limekiln* in the upper part of the town as aid and part in the general mischief!" And this is Dr. Bancroft's great authority for the local and marsh origin of this pestilence, and for its non-infectious nature! The whole of the four letters to the surgeon-general written by this physician—this infliction on the profession and the military service—abounds with similar drivellings and peculiarities. How admirably successful his endeavours to restore "the lost senses" of his "weaker brothers in medicine!" and "*to convince the public that nothing was to be dreaded from communication with the sick*," must have proved, may be inferred from the fact that, out of the civil population of this important fortress, amounting to nearly 14,000, only twenty-eight escaped an attack of the pestilence, and twelve of these had previously been affected either in the West Indies or in other parts of Spain. Fortunately for this place, at the height of a sanguinary war, Sir W. Pym and Sir J. Fellowes arrived to save 1200 of the soldiers, by segregation, from an attack of the distemper. Mr. Kenning, surgeon to the royal artillery in this fortress, published a detailed account of the introduction and subsequent progress of the pestilence; and Mr. Burd, who was at the head of the medical department of the navy, wrote officially to Lord Nelson commanding the fleet, cautioning him against communication with ships from Gibraltar. But, although Dr. Nooth's "*weaker brothers in medicine*" were bound to obey their superior officer, as to his measures, they were not constrained to conform to his opinions.

96. Although this pestilence had appeared several times at Cadiz, after long intervals, and at Malaga, places only about forty or fifty miles east and west of Gibraltar, when it might have been inferred that this fortress could not have escaped if the cause of the mischief had existed in the atmosphere, and that no police or quarantine regulations could have excluded it; yet we find that this place, as well as many adjoining places in Spain, had escaped up to 1804, owing to such regulation in parts, if not altogether. Measures of purification were adopted after the subsidence of this epidemic, and proved successful, so that the garrison enjoyed perfect health from that time until 1810. In this year the pestilence ravaged Cadiz* and Carthagena; and during its prevalence there, four transports from the latter port, two of them having on board deserters from the French army, anchored in the bay of Gibraltar. Sir W. Pym put them in quarantine, and the distemper appeared in all of them in a few days. He instituted measures for the separa-

brother, and two sisters, all residing in the house, were also seized with a disease of a similar nature" (p. 103). "The malady spread from the house of Santos to the adjoining buildings, while the rest of the garrison were totally exempt from it. For several days the distemper was confined to the range of buildings to which it had been traced, and where Santos lived; and it was observed to make a gradual progress among the different families who resided there, and to spread to the sheds in the neighbourhood." The farther progress of the distemper to the military as well as civilians may be learned in Sir James's work. (*See* p. 104, *et seq.*)

* In September, 1810, the harbour of Cadiz was crowded with ships from several ports of Europe and America, and several regiments of British troops were in the town. On the 11th the physician to the Board of Health discovered some persons with fever similar to that of 1800 and 1804; and it appeared from the reports that this malady was infectious, having spread gradually in the quarter where it broke out, four out of five of the first family attacked having died, the only surviving individual not having been seized; and it having been ascertained *that he had passed through the disease in* 1800. Sir J. Fellowes communicated this information to the British authorities; and measures, such as the circumstances of affairs allowed, were adopted to preserve the health of the army and of the crews of British ships; but these precautions, owing to various circumstances, could not be sufficiently enforced. The British troops, however, continued free from the disease, although it surrounded them until the end of October. Dr. Snow, physician to the army, in his official report states, that, "as far as his experience extends, and from all the information he has been able to collect, he thinks this disease contagious; and that nothing but the very active measures which were taken to check it in the beginning could have prevented its destructive influence from being more severely felt by the troops." Dr. Plenderleath, physician to the forces, had charge of the hospital at the hospicio at Cadiz, and he reports that the fever then prevailing was identical with that of 1800 and 1804; that it was violently contagious; and that the dangerous consequences to the army were prevented by the timely precautionary measures adopted; the army having lost only 25 men, although upward of 4000 were carried off by it from among the inhabitants. The Spanish physicians also believed the disease to be contagious, and imported.

tion of the healthy, and for preventing communication with the fortress. Notwithstanding these, the disease appeared on shore; but a strict supervision was instituted, and the sick were separated from the healthy, and removed to the neutral ground. A cordon of troops was placed around the infected part, and proper persons appointed to superintend the purification of houses, furniture, &c., and to report the appearance of the distemper. Owing to these measures, the pestilence was arrested before it had infected many in the fortress. In 1804 the infectious nature of the distemper was denied by the head of the medical department, and communication with the sick encouraged, and nearly all were infected, and nearly one half died. In 1810 the infectious character was recognised, the infected were segregated and removed to an airy locality, communication with these was prevented, the healthy protected, and the mischief was very soon arrested.

97. In 1813 the disease again made its appearance, and its commencement and progress were described by Dr. Gilpin and Mr. Fraser, deputy inspector of hospitals. The persons who brought the pestilence into the garrison were ascertained. One of them was ill when he arrived, and he communicated the distemper to those residing in the same house; thence it extended to both sides of the street in which the house was situated. All escaped who cut off communication with the infected. Of 500 persons confined to the dockyard, not one instance of infection occurred, although this was the spot most likely to be productive of terrestrial effluvia, and that suffered the most in 1804, owing to communication having been then unrestricted. When the pestilence appeared there were about 5000 persons within the walls who had been subjects of it at a former period; and, after a careful inquiry, there did not appear to be one well-authenticated case of a person having been infected a second time, at the termination of the epidemic. At its commencement nearly 8000 persons left the garrison, the greater part of them encamping upon the neutral ground. Very few cases occurred among them, and these chiefly after their emigration, and from previous infection. The strong breezes and current of air in this place were expected to prevent the accumulation and concentration of infectious effluvia, especially in tents, and, consequently, to arrest the progress of the malady; and the results proved the correctness of the inference.

98. In August, 1811, the disease appeared at Carthagena, and Mr. Vance, who had been infected by it in the West Indies, was sent to that city to report respecting it. He stated that it had not been confined to any particular part of the town, and that no persons were exempted from it but those who had been previously affected by it. He, however, mentions the important facts, that bilious remittent fever, which has been so frequently confounded with this distemper, also prevailed at this place, and that many soldiers were in the Royal Hospital labouring under the jail fever. Mr. Vance imputed the appearance of the malady in Carthagena this year to the general neglect of destroying the bedding, clothes, &c., of those who had died of it during the previous autumn, the infection lying dormant during the cold weather, and until called into activity by the summer's heat. He farther states, that the malady was introduced into Murcia, where it became destructive, by refugees from Carthagena, and that these cities had been placed in quarantine by the Spanish authorities.

99. Of the hæmagastric pestilence that has appeared on several occasions in Gibraltar and other parts of Spain, and has created so much interest and controversy, it may farther be remarked, that much additional information to that already furnished by Sir W. Pym, Dr. Gilpin, and Sir J. Fellowes has been adduced by Dr. Hennen, Mr. Redmond, Mr. Fraser, &c., and by the reports of the several commissions sent to inquire into the nature and source of the outbreaks of this pestilence in the south of Spain and Barcelona. And it may be premised, that the several epidemic manifestations of it which have occurred in the West Indies, in the ports of the United States, in Africa, and in several places in Spain, being admitted to have been identical as to nature, it necessarily follows that the evidence as to its source and propagation in one locality or epidemic equally applies to all other localities and epidemics. Mr. Redmond states, in his letter to Sir W. Pym, that the fever under which the 54th regiment suffered in Gibraltar in 1804, and again in Jamaica in 1808, was the same disease, and that it was infectious on both occasions. Of this he adduces the most convincing proofs. He notices the circumstances of the fever having been introduced by infection into the regiment in Jamaica in 1808; that it infected all who had not previously been attacked by it; that, in a few weeks, his two assistants, and twenty out of twenty-one hospital attendants, were infected; and that none of those who had had the disease in Gibraltar were attacked in Jamaica.

100. In the reports made by order of the governor as to the first appearance of the pestilence in the fortress, Mr. Kennedy, who recognised its nature, and watched its progress from the commencement, adduces the following evidence: At the beginning of September of 1804 the distemper appeared in the vicinity of Boyd's Buildings; and a bombardier and his wife, residing next door to the house of the person Santos, said to have imported the malady from Cadiz, where it then prevailed, and who was then labouring under it, were the first attacked in the artillery. Those who visited the bombardier and his wife were the first taken ill in that corps; and that part of the corps quartered nearest to their residence was the most unhealthy. Mr. Redmond, surgeon of the 54th regiment, traced the disease from man to man, and reports as follows: Whenever a man was admitted into hospital his comrade or bed-fellow soon followed. When an officer was affected, the servant was also affected; the same could be said of husband and wife. Of twenty-six persons employed as the hospital servants of this regiment, not one escaped. When officers and families in this corps avoided communication no disease appeared, but the moment they neglected this precaution they were no longer safe. Two families lived in seclusion at Europa, and escaped until, on the setting in of the rains in November, they returned to town, when the

whole were attacked, excepting one who had been in the West Indies.

101. Dr. Hennen states the following demonstrative and undenied facts: 1st. The deaths among the military in Gibraltar on the 1st of October, 1804, were upward of 130; and among them the garrison chaplain, who was attacked three days after attending a woman in her last moments. The five persons who carried the body to the grave were attacked on the fourth day, together with eight others who attended the funeral. Colonel Fyers, who at first had considered the malady non-contagious, was induced by these proofs of infection to change his opinion. He removed his family, consisting of fourteen in number, to Europa, established a strict quarantine, and they all escaped; while De Rolle's regiment, who were encamped within forty yards of them, but not prevented from communication with the inhabitants and the rest of the troops, had no less than 442 cases out of a strength of 635, the mortality being 197. 2d. Capt. Dodd's family, seven in number, and Mr. Straith's, three in number, lived in detached houses, and avoided all communication, the distance between the houses being 300 yards. On this intermediate space the 54th regiment was encamped. Of this regiment, consisting of 747 men, 456 were attacked, and upward of 100 died; and yet not an individual of Dodd's and Straith's families on each side of this corpse was affected.

102. It should be recollected that Dr. Hennen was no partisan; but he adduced the facts which came officially before him at Gibraltar with praiseworthy candour. He farther states other circumstances resembling the foregoing, and remarks, "That the sole cause, therefore, could not have existed in the atmosphere breathed in common by all, whether soldier or civilian, is rendered highly probable." The following facts farther demonstrate the truth of this inference. The Spanish troops doing duty at the Lines, 3000 in number, within one mile and a quarter of the garrison, had no sick. At San Roque, five miles distant, with a population of 6000, no sickness appeared during this epidemic period at Gibraltar. At Algesiras, ten miles distant by land, and five or six across the bay, the disease appeared on the 7th of October, 1804, the prevalent opinion being that it was imported from Malaga and Cadiz. At Los Barios, four or five miles from Algesiras, no precautions were used, and the disease extended thither and to Smeras, another small town about twenty miles distant; while at San Roque, and in the Lines opposite Gibraltar, all communication with Gibraltar, on the one hand, and with Algesiras, on the other, was completely cut off, and the distemper never appeared. Dr. Hennen* adds, "if these facts are not in favour of segregation and moderate quarantine, I know not what can be deemed so; at least they convey to my own mind the most perfect conviction upon these points." (P. 107.) It was stated, moreover, by Sir J. Fellowes and by Mr. Benyon, surgeon of the 10th regiment, "that every master of a transport who had business in the house of the agent for transports, whose family was attacked with the malady, caught the fever, while all those vessels in the mole, which had no communication with the shore, escaped."

103. That the clothes and bedding of the sick will propagate the distemper is shown by the following circumstance: A quarantine encampment of those who had not passed through the fever was formed in Gibraltar on the 9th of November, 1804. These men, with the exception of the 13th regiment, took their bedding with them; but the 13th, by the precaution of their colonel, left their old dirty bedding behind, and brought clean blankets in lieu: not a man of this corps was attacked; while on the 22d of this month, five men of other corps were seized, and within the three following days every regiment, except the 13th, had men taken ill. (Hennen, p. 40.) In whatever light this fact may be viewed, it suggests a most requisite precaution; and that such a precaution should have been neglected may be viewed as one of the many evil results arising out of the doctrine so assiduously inculcated hy the heads of the medical staff on the outbreak of the pestilence (see § 95). The non-infectionists argue that the malady is not propagated by emanations from the sick, either direct or by fomites, and hence that no such precaution as the one now stated is requisite. That it was most requisite—that the neglect of it in this and on numerous occasions in America, the West Indies, Africa, and in Southern Europe, was most calamitous—even most murderous, is apparent to any reflecting mind. Ten times as many lives have been sacrificed during the last sixty years by the abettors of a most erroneous doctrine—by following the false glare of what has been ignorantly deemed the lights of science, instead of adopting the suggestions of common sense—than have been lost on the field of battle.

104. Mr. Fraser, the experienced chief medical officer at Gibraltar during the epidemic of 1813 and 1814, writes as follows: "The features of the epidemic; its course through families; the early and almost universal seizure of the medical officers, clergy, and rahbis, and of those immediately employed about the sick, if not emancipated by a previous attack; the sickening of washer-women, the good effects of seclusion, and the remarkahle escapes of those who took particular precautions, led to, and finally confirmed the belief of the infectious nature of the malady." He farther states, what my own observation has confirmed, "that, of the number of medical authors who deny the contagious properties of the disease in their closets, many yield to the ineffable impression made hy the immediate view of the epidemic calamity," and acknowledge the communicability of it by their fears, by their acts rather

* Dr. Hennen, who was at the head of the medical department of the garrison at Gibraltar when the epidemic pestilence of 1828 broke out, and who died of the distemper at an advanced period of this epidemic, must have seen enough in the course of the early part of it to confirm his opinion as to the infectious nature of it, or to establish his belief in this property if it were previously not quite determined; for in an official communication *to the military secretary of the governor*, he writes as follows:

"*Gibraltar, 24th Sept.*, 1828, 9 *o'clock. Immediate.*

"Sir: Nothing has yet been done about the infected bedding at the naval hospital. Pray allow me to order it over the line wall at Camp Bay instantly, as much loss of life may be the consequence. The barrack master's plan of taking it direct to the sand-pit is fraught with danger. It should be steeped in the sea for sixty hours at least before it goes to any place, when it may be mixed with other beds.

(Signed) J. Hennen, M.D."

than by their words—by "their personal manners; their care of those dear to them; the placing of their patients under observation; and the adoption of other means, which could originate solely in a latent belief of infection."

105. Dr. Arejula, an eminent Spanish physician, and author of a work on this pestilence, states, that "a regiment of dragoons in the centre of infected places in 1800, continued in uninterrupted good health during the whole time of the continuance of the epidemic, guarded from its dangers by the good sense and vigilance of its commanding officers, who formed a cordon from the corps itself for the protection of its own quarter." This fact is quoted by Dr. Jackson from Dr. Arejula's work, with the remark, "that it is imposing, and, if the truth of it were authenticated officially by the signature of the officer who commanded, it would go far to decide the question under discussion." But the fact respecting the immunity of those shut into the dockyard in Gibraltar in 1813 (§ 87) is equally strong and admits of no doubt. Why does Dr. Jackson throw doubt upon a fact stated by so respectable a physician as Dr. Arejula is known to have been, when he might have ascertained the accuracy of it when he was at Cadiz not many years afterward? It is, however, duly credited by Mr. Fraser, who must have possessed some means of ascertaining the truth of it. Indeed, the fact does not repose upon the testimony of Dr. Arejula alone, nor does it require the confirmation of Mr. Fraser, for it should be known that it was witnessed by the French commission sent to the south of Spain in order to investigate the nature of this epidemic, and was adduced, in the report of that commission, with many other facts, proving the introduction and infectious nature of this malady; which report is published in the original French in Sir W. Pym's work on this pestilence, and ought to have been known to Dr. Jackson* long before he either went to the south of Spain or wrote upon this distemper, seeing that it was published both in Paris and London long previously, and again noticed by the French commission sent to Cadiz to report on the epidemic there in 1819.

106. M. Pariset, in his report of the progress of the pestilence in Andalusia in 1819, states, that it was in all respects that of an epidemic diffused by contagion. That, having appeared at a single point, it extended itself like an inundation, and gained in succession places near its source, and progressively those more distant, respecting only such places and persons as protected themselves from communication with those already infected. Thus, appearing first in the Isle of St. Léon, it pervaded Cadiz, where no means of arresting its progress had been taken; attacking two thirds of the inhabitants, it was conveyed to Xeres and Seville. In the last named of these cities, measures were employed to arrest its diffusion, and in Xeres similar measures were adopted, but not so strenuously carried out as in Seville; and the results in both these cities were proportionate to the vigilance and promptitude with which those measures were enforced. M. Pariset farther states, that the pestilence appeared in no town or village adjoining Cadiz, Xeres, or Seville, without previous communication with one or other of those infected cities, or with some other place already infected; that in populous towns the distemper prevailed in proportion to the freedom of communication with those primarily attacked; and that, wherever all communication was cut off in due time, no instances of the malady occurred. (Pariset, &c., p. 64–67.) It may be mentioned that, in the case of this epidemic, as well as of others, the distemper did not appear in distinct and separate points or localities at the same time, unless communications had previously existed between those and some other places already infected. M. Pariset goes on to remark, that in 1819, as well as in 1820, wherever the distemper appeared, it commenced in some individual who communicated it to those who waited upon or nearly approached him, and that those sickened with it either in succession or together. Thus the inhabitants of the same apartments, then those of the same house, then the adjoining houses and those opposite, then the adjoining streets, &c., were infected in succession. One quarter of a town, or street, or house, being infected, persons proceeding thence into other quarters or streets, or coming from these into the infected houses, either were themselves infected, or carried the infection with them. This able writer farther observes: "Open the work of Dr. Arejula, a treatise founded on the most authentic documents and the most enlightened observation; read what this very eminent physician has adduced respecting the origin and progress of the malady in Cadiz in 1800; in Medina Sidonia in 1801; in Malga in 1803 and 1804; and pass on to the appearances of it in the last year (1804) in Ronda, Antequerra, Montilla, Espejo, Rambla, and Alicant, in all which places it was introduced from Malaga; follow his recitals respecting the epidemic of Carthagena in 1804, showing the transmission of the infection to Vera, by the wife and daughter of an officer who arrived at the latter place during the prevalence of the pestilence in the former, and who were taken ill soon after their arrival at Vera; the relations of them, the inhabitants of the same house, and those of adjoining houses, being successively infected; peruse other facts of a similar nature adduced by this physician, and compare them with those which have occurred in Andalusia and elsewhere, and it will be impossible for the candid mind to resist the conclusion that this malady is eminently contagious,

* Dr. Jackson was sent to the south of Spain in 1819 to inquire into the pestilential epidemic prevailing there at the time. He returned to England and wrote a very laboured work respecting this distemper, in which the various modifications of it, according to the temperament and habit of body, are described, with numerous arguments, pleadings, &c., against infection, now and then, however, with certain admissions, proving the opposite doctrine to that for which he argues. What reliance may be placed upon his opinion as to the matter I shall leave the reader to determine, after having read a paragraph, to which I have already referred, actually admitting the presence of infectious properties in this pestilence, and which concludes as follows: "I was indisposed myself on various occasions, never in health, though my visits to the sick were desultory and comparatively few." (*See p. 49 of his work.*) This having been the case, as Dr. Jackson admits of himself, how was he enabled to describe so fully, I cannot say so accurately, this distemper? and how came he to support a most important, but dangerous, doctrine as to the origin and nature of a pestilence, the occasions of his seeing and judging which he admits to have been "*desultory and comparatively few*?"

inasmuch as it rests upon evidence the most conclusive that can be offered; and upon facts as positive and incontestable as historical facts can be."

107. Don J. A. Ferrari, physician in Xeres, in his account of this pestilence as he observed it in that city, has offered some very judicious observations and recorded several important facts respecting the topics now under consideration. "Xeres," he states, "is situated at an elevation of about sixty feet above the level of the sea. It experienced the yellow fever in the years 1800, 1804, 1819, 1820, and 1821. There are no morasses, marshes, or other sources of insalubrity within its boundaries." Whence, then, did this distemper proceed in those years? If it is proved that heat alone, however excessive, cannot produce it; and if this city is free from those local causes to which it has been imputed by the anti-contagionists, no other source or cause of it proper to this city having been shown to exist, whence did it arise? It is satisfactorily proved that, in all these years, the distemper existed, previously to its appearance in Xeres, in Cadiz, Malaga, San Fernando, and Puerto Santa Maria; and Dr. Ferrari shows that Xeres was infected from these places. In order to decide the questions of importation and contagion, he remarks, "it will be necessary to prove, in the first place, the arrival of some infected person in some particular quarter, and this is precisely what I shall endeavour to demonstrate from the facts which took place in this city during the five epidemics which have been experienced in it since 1800, and which have fallen under my observation. In all these the mode of invasion has been the same. The malady had appeared in some of those towns, from which the infected person, who introduced the contagion into Xeres, had removed; as fully proved by the municipal Board of Health in this city (the evidence and documents to this effect being lodged in the library of the board); and it has uniformly happened that the fever began in that quarter only where such person had lodged." "At the time of its appearance, or before its progress had extended, the malady existed only in the quarter in which it was first seen. Confining itself to that for some days, its progress slowly increased, following the direction of the street in which it first appeared; and of the houses adjoining the first infected. When it had spread through the city its propagation increased in proportion to the great number of communications which the increase of sick occasioned; and during all these periods it was uniformly observed that the disease began with units, proceeded by tens, and concluded by hundreds. When we consider," he adds, "that the distemper has always appeared in the seacoast towns having intercourse with the West Indies, and extended itself to the adjoining towns and villages having had a communication with these, and not in those which have no such intercourse, or with which all communication has been cut off; nor with those in the centre of the peninsula, nor in any other save coast towns, although the latter may be less exposed to heat than the former; if it has been observed that its prevalence in Xeres took place only at the period when its importation could be traced; that during the time when the intercourse was less and the navigation less common, the disease was also less frequent; and if the patient suffers the distemper only once, as in the case of the smallpox, can we doubt of its importation and contagion?"

108. Dr. Ferrari thus states the results of his observation: "1st. That the cause of pestilential yellow fever is a poisonous miasma of a peculiar kind. 2d. That this contagious poison is the effect of the union of certain causes, developed by a high range of temperature. 3d. That the high temperature is only a necessary condition, but not the exciting cause. 4th. That as, in this city (Xeres), there does not exist, nor has ever existed, that union of circumstances necessary for its production, this distemper is not spontaneous, but has been imported as often as it has been experienced. 5th. That, from its mode of invasion, communication, and propagation in this city, we are necessarily led to consider it contagious; and, 6th. That, although it is certain that contagion, and not heat alone, may reproduce this pestilence, the reproduction is neither so frequent nor so easy as is supposed."

109. This pestilence appeared in Barcelona in 1821, and extended to several places in the vicinity, and a commission was sent out by the French government, consisting of four eminent physicians, to inquire into its source and nature; and in 1823 a very detailed account of it was published by the commission, forming, perhaps, the best treatise extant on this distemper. This commission consisted of MM. Bally, Francois, Pariset, and Mazet, the last of whom died at Barcelona. Barcelonetta first experienced the malady, although this suburb is remarkable for its cleanliness and dryness; and soon afterward the port; these places having the most frequent intercourse with the shipping. About the end of April, 1821, many vessels left the Havana and Vera Cruz, where this pestilence was then prevailing, for several destinations; a large number proceeding to Barcelona, where they arrived about the end of June and in July. During the voyage to Europe many of the sailors died with the black vomit; their clothes and bedding being generally preserved and brought in the vessels. Notwithstanding these occurrences, free communication became established between the port and the ships, and between the ships themselves. These facts, as well as the following, were furnished by the authorities in Barcelona to the commission, but were mostly verified by it in various ways. The ship "Grand Turk" had conveyed a number of negroes from Africa to Cuba; these negroes suffered severely from malignant dysentery. Having landed them at the Havana, she departed thence for Barcelona, and arrived in sixty-one days, having lost several of her crew by yellow fever on the passage. Soon after her arrival the captain received on board his wife, children, and a servant. The whole of this family were very soon afterward taken ill, and died at Barcelonetta. The mate also entertained on board of this vessel his wife, and his wife's sister and brother. Twenty-four hours afterward his wife's sister and brother were attacked with fever, and both died with black vomit; several other persons were also seized after visiting this vessel. Now the commission assert that they went on board this

vessel and heard these facts stated by the captain and mate; and they, moreover, furnish farther details of the infection conveyed in other vessels which arrived either about the same time as this or soon afterward, and communicated to persons holding intercourse with them; and of the various circumstances which occurred in connection with the appearance of the pestilence in the city, all tending to explain the rapid extension of it, and the very inefficient measures taken to restrain its progress. It is impossible for me to advert to the numerous facts and circumstances bearing on the topics under discussion adduced hy this commission They may be perused in detail in their able work. From these they contend, 1st. That the pestilence which desolated Barcelona and several places in the vicinity in 1821 is the same distemper as the malignant yellow fever of the West Indies, and as the epidemics which have desolated the south of Spain at various periods since 1800. 2d. This pestilence is eminently contagious. 3d. That it was imported into Barcelona by the vessels which left the Havana on the 28th of April, 1821, and soon afterward. 4th. That the germs of this distemper conveyed by these vessels reside either in those actually sick of it, or in their clothes and bedding or other effects similarly contaminated, or in the air respired in these vessels by those visiting them.

110. Now these facts have surely either been unknown to, or, if known, entirely suppressed by Dr. O'Halloran, who has professed to give an account of the Barcelona epidemic, and who has espoused the doctrine of local origin and non-infection. This writer states that persons sickened of the pestilence who observed the strictest seclusion; and that the attendants on the sick, the nurses in the hospitals, and the washers of clothes and bedding "generally escaped the impression of the malady." Notwithstanding this most unblushing assertion, the facts, as verified by official documents and by medical men of high character, are of the most opposite description; namely, that very few of the nurses and attendants on the sick escaped; that next to these confessors and priests in attendance on the sick were most frequently attacked; and next to them medical men. Thus the Capuchins were constanly engaged in assisting and confessing the sick, and their whole number, sixty-three, were infected, and twenty died; and, so far from his assertion being correct as to the failure of seclusion, I may state that the evidence of its success is the most complete. The following convents, the Capuchins, Los Angelos, Santa Theresa, San Juan de Jerusalem, the Hieronymites, and the Carmelites, observed the strictest seclusion, and not one of them had a single inmate infected; while all the other convents which communicated with the city had the greater number of the sisters attacked. Thus the Magdalen, consisting of fifteen sisters, lost ten, all having been infected. The sisters of Jerusalem, consisting of twenty-eight, had eleven deaths, and the others in nearly the same proportions. The French commission state that at least twenty-two physicians and surgeons died at Barcelona of the pestilence, besides medical pupils, assistants, and apothecaries. In the military hospital almost none of the assistants to the physicians and surgeons escaped the disease, and many of them died. One of the members of the commission stated, that the great mortality among the medical men at Barcelona was an illustration of what he had witnessed during the epidemic yellow fever of St. Domingo in 1802, which carried off, in eighteen months, 206 physicians and officers of health.

111. In consequence of a decree of the Cortes of the 13th of December, 1821, requiring the authorities of Cadiz, Malaga, Barcelona, and the principal cities which suffered from the hæmagastric pestilence to consult the scientific bodies, and the most celebrated physicians, regarding the existence of contagion, medical juntas were formed in these cities and several other places; and all these convocations decided that this distemper is unquestionably contagious; that it is exotic and imported; and that the best means of preserving the country from its ravages is the establishment of regulations which may prevent the entrance of the pestilential infection.

112. It is of the utmost importance to the community, as well in temperate countries as in tropical regions, that the subject so long agitated as to the nature of this pestilence, should be put to rest. The questions, as to the origin and diffusion of it, have been explained in so different, and even so opposite a manner, during the early part of this century, and discussed so frequently and so variously—in a calm and philosophic temper by a few, with intemperance and an incoherent want of argument by many, with manifest ignorance of the subject and even of the language in which they wrote, by not a few—that they have been received as matters of the utmost doubt and uncertainty by those who have mere authority only to guide them to a just conclusion, without having suffered that experience and toiled in that field which might have enabled them to judge for themselves. Much that has been written upon the subjects embraced by the questions at issue has tended to mystify, rather than to enlighten; to involve in utter confusion when attempting to explain what was already clear and unmistakable; and to gloss with a false science what was manifest to common sense. Let the writings of the apostles of non-infection, especially as regards this distemper, be adverted to, and the mode in which they handle a very simple question be considered. In our simplicity we believe that, when one subject becomes infected with smallpox, or measles, or scarlet fever a short time after having been near to one or more persons already affected by either of these maladies, the infection has been communicated hy these persons, whether the disease in question be epidemic at the time or not; and that, when persons who have recently experienced either of those maladies, or when the clothes of some one who has recently died of it, have been conveyed into places where the disease did not then exist, but where it soon afterward broke out and prevailed, the infection of that particular malady was actually introduced. Now, observing these occurrences so frequently as to become familiar in respect of these distempers, and knowing that occurrences identical with these in every particular have taken place in regard to this pestilence

can we be so blinded by a false doctrine or by prejudice as not to infer that the latter belongs to the same category as the former—that the one is infectious as well as the other; more especially when, like them, it attacks the same frame only once, as long since stated by many observers, and now satisfactorily determined and admitted? But the enlightened observers of what is going on in the "bowels of the earth" consider this view of a scientific subject too common-place for their credence, and see it otherwise; and, in one sense of the word, although not in that which they would attach to it, much more profoundly. They either avoid allusion to this mode of communication altogether, or endeavour to explain it conformably with what they would term scientific views; and in place of what is based on incontrovertible evidence—upon what is palpable and unmistakable—they substitute hypothesis and mystery, and adduce vague and unintelligible explanations to veil what is manifest, and to prevent the adoption of measures which alone can protect the lives of thousands, however they may for a time affect the pecuniary interests of the few—of the speculator and the capitalist, the modern curses of the general community. With no other object than the promulgation of truth, the surest basis of national prosperity, as it is of all human science, I proceed to notice the last appearance of this pestilence in Gibraltar, respecting which the closest inquiries have been instituted both by a board of British officers and by a commission of physicians sent by the French government; and I shall adduce nothing but what has been satisfactorily proved by the most irrefragable evidence.

113. By the official returns there arrived at Gibraltar between the 1st of June and 1st of September, 1828, several vessels from Cuba and ports of Spanish South America, on board which at least ten deaths occurred during the passage. The ships more especially suspected were the Meta, the Hyperion, and the Dygden. They had come direct from Cuba and the Havana; having been from forty-six to fifty-four days on the passage. Shortly before leaving the Havana, where this pestilence was then raging, the Dygden lost four or five of her crew by the distemper; and at least one of the men engaged to supply their places came directly from the hospital, where he had laboured under this malady. During her passage to Gibraltar of forty-six days, nine persons were ill, and two died. This vessel was put in quarantine; but the quarantine appears not to have been rigidly enforced; for, during its continuance, she was visited by smugglers; and at its termination, if not before, dirty clothes were landed to be washed; and two sailors were admitted into the civil hospital from this vessel evidently ill of this distemper, although it was either not recognised, or not entered in the books of the hospital as such, by the medical attendants. From the smuggler and washer-woman, to whom the foul clothes were sent, and from their families, the disease spread; and to them, as well as to others who held communication with the importers of infection, it was traced much more correctly than it could be possible to trace the early progress of an epidemic of smallpox or scarlet fever, the infectious nature of which is undisputed.

114. It was satisfactorily proved to the boards of inquiry and to the French commission, as shown by their reports, that, in addition to these facts, the mate of the ship was ill while in quarantine, and not reported to the inspector; that one of the men who went on board to assist in navigating her to Cadiz was taken ill a few days afterward; that the clothes of the men who died on board this ship were sold to sailors who landed from her about the 6th of August while at Gibraltar; that the sister of a sailor who had landed from this vessel, and who had had the black vomit fever in the Havana immediately before he embarked from that place for Gibraltar, received a bag of foul clothes belonging to that sailor, and fell sick on the 20th of August; that the health guard, Teste, who was placed on board this ship on the 27th of July, declared to several persons that she brought the yellow fever to this garrison; that the sister of this health guard, who, on the 11th of August, assisted to wash his clothes, which he brought from this ship, fell sick on the 21st; that the first persons attacked were the connexions of sailors and health guards, and persons who had recently been on board ships, and washer-women; and that the ship Dygden was admitted to Pratique on the 6th of August, and the first case of the pestilence occurred on the 12th of the same month. It cannot be disputed that, when the sailors of this ship landed at Gibraltar with the clothes of the men who had died of this distemper on board her, all the collateral circumstances favourable to the propagation of it were present, namely, the sultry calm of a southern autumn; the peculiarly sheltered, unagitated, and humid state of the atmosphere at this season; the steady high range of the thermometer, and the abundance of subjects liable to receive infection from not having experienced the protecting influence of a previous attack. From the above evidence; from the circumstance of this fever being identical with the black vomit fever of the West Indies, and with the epidemic fever, which have committed such ravages in this garrison and in the south of Spain at different periods; from the fact that it is essentially different from every fever indigenous in any part of Europe in its mode of attack, its symptoms, its duration, its consequences, and its anatomical characters; and, above all, from its affecting the same individual only once during life, it was rationally inferred that this malady was imported, and was not of local origin.

115. These inferences were further supported by the considerations: 1st. That not one case of fever identical with this pestilence had occurred in Gibraltar within the thirteen years preceding 1828, excepting four, which occurred in lightermen and Jews who had been in the habit of having intercourse with West India ships; although it is presumable that during that period all the physical causes inherent in the place, and capable of generating disease, had been in as full action as at the breaking out of the epidemic; and although the population was more dense, and the houses less commodious during these years than in 1828, as proved by undoubted evidence. 2d. That there was no evidence to show that there is any source of malaria within the Gibraltar territory, or that the effluvia arising from drains, even when they

were most offensive, had any share in producing the distemper. The general conclusion, that this pestilence was imported into Gibraltar in 1828, and that it was afterward propagated by direct communication, and by means of the clothes of persons affected by it, is conformable with facts observed in numerous other places, and with the results of enlightened observation and rational reflection, with the dictates of good common sense.

116. Dr. Jackson, in his work on this pestilence, especially as it appeared in the south of Spain in 1829, evidently considers, and in this respect errs with many others in thus considering it identical with the endemic of the West Indies, and differing merely in its epidemic form; that it is the endemic heightened in degree, and rendered more prevalent owing to the intensity and diffusion of the terrestrial cause. It is painful to observe how injuriously this impression has acted on his mind while describing the true pestilential disease; for in that description he has mixed up many of his recollections of the West Indian endemic, and has wandered into lengthy lucubrations as to the type of the malady, and as to the influence of temperament in modifying its form, and has furnished the most undoubted internal evidence that he entertained no distinct views of the distemper, inasmuch as the whole is laboured, and in many places quite unintelligible. He remarks, that "there is not one practitioner in one hundred, who has resided for years in the West Indies, who believes that the concentrated endemic of that country, usually called the yellow fever, is a disease which possesses the power of propagating itself from person to person within the tropics." Certainly there is not. It is well known that all the writers on West India diseases during the last and present centuries admit this, but many of them—nay, the majority—also admit, what is the fact, that the severe endemic of that climate is not this pestilence; that the former is liable to be mistaken for the latter; and that both are often confounded together, although they are as distinct, indeed more distinct, from each other than measles and smallpox. And in this Dr. Jackson errs with the minority, using at the same time terms which involve a theory, or mean nothing. Thus his "concentrated endemic" must either mean the more malignant form of remittent, which I have described, from frequent observation of it in warm climates, in the *art.* Fever, by the name of *malignant remittent*, and which I know well is neither infectious nor the pestilence now under consideration, the differences between which have been long since pointed out by many very intelligent and experienced observers (*see* § 39, 121, *et seq.*).

117. Those who rightly contend for the infectious nature of this pestilence view it as entirely distinct from the endemic and sporadic malady or remittent which resembles it, in some respects, as shown above (§ 39). The non-infectionists, on the other hand, consider both diseases to be the same; the endemic or sporadic malady being, as they believe, heightened in degree under peculiar circumstances of the soil and situation, and of the atmosphere. They contend that these circumstances are sufficient to account for the phenomena observed in the epidemic or true pestilential disease without calling in the aid of infection. As the infectionists themselves admit the non-infectious nature of the endemic or sporadic fever which occurs in warmer climates, and which often appears in more temperate countries, during hot seasons, and assumes many of the characters of hæmagastric pestilence, the problems to be solved are: 1st. Is the latter distemper also non-infectious? 2d. As it is admitted that the former arises from terrestrial emanations or malaria, during high ranges of temperature and a humid state of the atmosphere, altogether independently of infection, does the latter distemper also acknowledge only the same sources, when they are rendered more intense?

118. What has already been adduced may appear to the unprejudiced sufficient to solve the above problems. Phenomena, circumstances, and facts cannot be annihilated by special pleadings, by confident assertions without proofs, and by vague hypotheses; and when we find that these have been chiefly confided in by the non-infectionists, and that they have confounded together two diseases possessing very distinct and altogether different characters, and, in their various pleadings, have imputed to one malady that which does not belong to it, because it appertains to the other, are we not compelled to believe either in the innocence of their ignorance, or in the guilt of their sophistry and unfairness? I shall leave the reader to adopt either alternative he pleases after perusing the following coquettings with infection by the greatest authority which this party can boast of, desiring only that the postulates, and the terms either of "no-meaning," or involving some crude hypothesis, may not be overlooked. Dr. Jackson ruminates as follows: "The general atmosphere of an epidemic circle is charged with a material of an unknown quality, distinctly offensive to health and animal life. The epidemic influence is general throughout a given district, more concentrated at some points of the district than others, from causes totally unknown to us, or only partially known. The atmosphere in the apartments of the epidemic sick, particularly if these apartments be crowded and ill-ventilated, may be supposed to be charged with this offensive material in a comparatively higher proportion than the common atmosphere, inasmuch as it has there less opportunity of being diffused. That, however, is only supposition; the following is fact: *Persons of every habit, but more especially persons of susceptible habit, who enter into the apartments of those who are ill of the epidemic fever, rarely fail to experience unpleasant sensations at stomach, viz., distention and irksomeness; not infrequently uneasiness in the bowels; suspension or change in the natural functions; headache, heat, pain of the eyes, thirst, white tongue, disturbed sleep, and dreaming, amounting to revery.* These beginnings of the morbid act are local; and, as such, they are for the most part removable by the prompt application of remedies that act locally, that is, by emetics, purgatives, or others, which produce decided changes in the secreting surfaces of the alimentary canal." "It is not said that the impressions which produced indisposition on these occasions were impressions from the cause of yellow fever; it is evident that the general atmosphere was epidemic; and it was probable that the atmosphere of the sick ward

was so in a higher degree than elsewhere; or, if not so, that the diseased act was there suffered to explode with more facility, in consequence of the diminished coercive energy of the atmosphere which filled the sick apartments" (p. 49).

119. I have copied the above verbatim; the postulates and nonsequiturs will be readily recognised without much logical aid. If the passage which I have put in italics is not a convincing proof of infection, especially when recorded so innocently, so unconsciously, by the arch non-infectionist, I know not what else can be considered as such. But wherefore should Dr. Jackson say as above, that "emetics, purgatives, or others which produce decided changes in the secreting surfaces," act only locally? His experience surely should have proved the contrary. The reader will farther perceive the "no-meaning," or absurdity into which he lapses at the conclusion, when he attempts to escape from the very obvious, the palpable effects admitted by himself to be produced by the emanations from the sick. But he goes on farther to admit as follows: "The yellow fever, during the reign of epidemic influence, often strikes like a pestilence by the mere concourse of people in a close place; and, if a mass of sick persons be collected into a hospital during the epidemic season, the common emanations from the sick bodies, whether saturated with contagious particles or not, often act offensively on those who enter the circle, and often appear to be the cause of the explosion of a disease which, without such accessory or changed condition of the medium in which men live, would have probably remained dormant for a time, and perhaps forever. The instances of persons who have lived in apparent good health in simple epidemic atmospheres, and who have become sick soon after they entered into the circle of a crowded assembly, or the crowded wards of a hospital of sick, are numerous, and so well marked that they stagger, on a superficial view, the opinion here contended for, of the non-contagious nature of the yellow fever" (p. 44). To be sure they do, and, being admitted by Dr. Jackson, they become evidences of infection as strong as "proofs from holy writ." But the superficial view, which he here deprecates, may, nevertheless, be the just one; at all events, I leave the more profound doctrine of the fons et origo mali e profundis, which he considers the truly scientific and credible one, for the adoption of those who,

> "By the glare of false science betrayed,
> That leads to bewilder, and dazzles to blind,"

can see no truth in that which is a topic of general belief, which has good common sense to recommend it, and which is based on established facts, and supported by numerous collateral evidences and analogies.

120. I have already, and perhaps sufficiently, adverted to the circumstances of the great majority, if, indeed, not all of those who believe in the non-contagious nature of the hæmagastric pestilence, having confounded this distemper and the more malignant forms of remittent or endemic fever with each other (§ 121–123), and of the infectionists having considered that this pestilence is distinct from the latter; that it is infectious, but that the endemic is non-infectious, and of local origin; and that, while the same person cannot be infected by the former oftener than once, he may be attacked by the latter twice, or even oftener, especially under circumstances which will appear in the sequel. To these topics it is necessary more particularly to advert.

121. *d. That this pestilence is not identical with the endemic or remittent yellow fever of Africa and America*, I can assert, from my own observation and the testimony of the most experienced writers. The results of my observations are certainly in accordance with the evidences furnished by Mr. Boyle, and several of his contemporaries in the British settlements in Western Africa,* in so far, at least, as that the former distemper is distinct from the endemic fevers of Sierra Leone and the west coast of Africa. The hæmagastric pestilence appeared at Sierra Leone in 1823 and 1829, presenting identical characters, in its invasion, progress, and termination, with those observed in the West Indies, North America, and the south of Spain; and although it was most fatal among the crews of vessels, and those recently arrived, yet it carried off many of the old residents and coloured population, and of those who had undergone the seasoning and remittent of the country, and who were considered safe from any return of these. The above writer and Dr. W. Barry agree in stating this to have been "a fever, not entirely new, but extremely rare" in that country; and that it appeared during the healthy season, when the endemic remittent fever is not prevalent. That this pestilence was infectious at Sierra Leone is shown by the conviction to this effect of the educated and respectable part of the population; by the history of it in the Bann and Eden ships of war, and in many other vessels; and by its extension from the Bann to the military in the Isle of Ascension, and to other ships. There is generally much difficulty in distinguishing the malignant remittent of Africa from this pestilence, owing to the imperfect remissions of the former, and to the presence, at an advanced stage of fatal cases, of many of the symptoms characterizing the early and rapid progress of the latter; and hence the epidemic is generally advanced, or has extended to many, before its nature is recognised. Opinions as to the origin of these two epidemics in Sierra Leone were by no means consistent with each other. The disease was said to have commenced among the inland native population, and to have extended to this town and the shipping, as well as to places to the northward of it on the coast.

* Misstatements having appeared, although of slight consequence, respecting the author's visit to Western Africa, he thinks it due to himself explicitly to state that he never had the honour or advantage of being in any public service, or in any service whatever; that his passages to and from Africa were altogether at his own private cost, and were dearly paid for before embarking, in both instances; and that his travels between the several British settlements and other places, as well as his residence in the former, were also at his own charge and expense. He may farther state that, having obtained his degree in medicine after a continued residence of seven years at the university, he has exercised his profession in no other capacity than that of physician; and that he employed the time which intervened between that of leaving the university and that at which he joined the College of Physicians of London, and commenced practice in the metropolis, in travelling, unaided and unpatronized, in various countries, with the view of obtaining medical knowledge.

There can be no doubt of the fact of the prevalence of this distemper among the natives of those places before it appeared at Sierra Leone, but it was milder, less prevalent, and less fatal among them than among Europeans. On the other hand, the grand jury of this port state in their presentment, as respects the epidemic of 1829, "that they attribute the present unhealthy state of Freetown to the practice of landing slaves from the prizes in the centre of the town, where they are necessitated to remain under the disease with which they are afflicted in a small yard, not more than 120 yards square."

122. It would he more tedious than instructive for me to adduce even a part of the evidence now before me of the distinct nature of this pestilence from the endemic remittent yellow fever of warm climates. Every writer, from Lining to the present time, who has espoused the infectious nature of the former, and all those whose opinions I have noticed above, both British and foreign, agree in admitting the distinction, while many of the non-infectionists either cannot recognise a difference, or do not choose to do so, as it militates against their doctrine. I shall only adduce the opinion of M. Guyon, one of the chief physicians attached to the French army which occupied Cadiz in 1827 and 1828; because he states that he formerly believed in the identity of this pestilence with the malignant form of remittent fever; but that his observation and experience in Spain had convinced him that he was wrong. He remarks: "Not that, with all my belief as to these diseases being identical, I had failed to perceive well-marked differences between the one and the other; but it must be owned, such is the influence of an opinion already formed, that, of the facts connected with it, we see only the side favourable to that opinion. The differences hetween these two maladies are many;" and he forthwith proceeds to point them out with much accuracy. Much of the misconception which formerly existed respecting these maladies was owing to the unfortunate names given to them, especially to the application of the term yellow fever, which, as will be seen from what has been adduced from various writers, was generally applied to this pestilence, although the yellowness of the surface was more remarkable in the severe endemic remittents, not only of Africa and America, but also of the south of Spain and shores of the Mediterranean.

123. The remittents, whether bilious, gastric, malignant, &c. (*see* Fever, *Remittent*), with which this pestileuce has been confounded, are diseases depending upon the nature of the locality—upon exhalations from the earth's surface and its productions, varying, however, in character and severity, with the temperature, humidity, and stillness of the atmosphere, and most probably also with the electrical states. But this pestilence is produced in all cases by an animal poison—by an infectious miasm generated by, and emanating from, the affected; and contaminating the immediately surrounding air, and various animal or other substances capable of imbibing it and of imparting it to the atmosphere, but requiring certain states of the air as regards temperature, humidity, and stillness for its dissemination; and thus, as it will be more fully seen from what has been stated respecting *remittents*, and from what has been already adduced as to this pestilence, the one proceeds from a distinct and specific cause, the other arises from terrestrial exhalations, of various grades of concentration, producing co-ordinate effects. This pestilence, wherever it appears, presents certain prominent features, like smallpox or scarlet fever, however it may vary like them in severity and in certain subordinate characters. If it proceed from terrestrial exhalations, as the non-infectionists suppose, how is it that it does not appear in many situations where these exhalations are the most indisputably produced, and are as remarkably favoured by a humid, warm, and still atmosphere as in those places where it has occurred the most frequently? And wherefore is it not observed within the tropics, in the eastern hemisphere, where the most malignant as well as the most mild forms of remittent fever are prevalent at some season or other?

124. Dr. Wilson, who observed this pestilence in the West Indies, states that 117 cases occurred within a few weeks, and that "though they varied much in violence, and in many other points, they were uniformly continued, and that nothing like remission could be detected in any of them" (p. 180). Jackson, Bancroft, Fergusson, and others, however, believe in obscure remissions, confounding this malady with remittent fevers; and hence arguing most illogically against the protection from it afforded by a previous attack. They farther contend that reasons for not detecting remissions are to he found in the "violence of cerebral action and speedy gangrene of the stomach;" or in the circumstance of the functions having been overwhelmed and extinguished. Now cerebral action is often not violent. The power of the hrain is rather depressed than excited; and it is well known that the stomach is not found gangrenous in those cases in which the examination of the body after death is not too long delayed. Besides, in a large proportion of cases, there is neither overwhelming nor extinction of the functions, but a slight grade of febrile actions, in many instances followed hy quick recovery; and yet, even in these, no remissions occur. But this topic requires no farther illustration. Another important circumstance evincing the marked distinction between this pestilence and the worst forms of endemic fever, is the fact that recovery from the former is generally rapid and complete, without the visceral enlargements and obstructions so frequently observed to follow the latter. The morbid appearances after death are also different; for, while the liver and spleen are generally more or less congested, enlarged, and softened by the endemic remittent, these organs are even paler and less vascular than natural, although often somewhat softened in common with the rest of the textures, in the hæmagastric pestilence.*

* Dr. Imray states that, in the epidemic of this pestilence which he observed in Dominica in 1838, the yellow hue extended over the body, but was deepest in the neck, shoulders, and breast, with here and there dark irregularly-shaped spots and blotches, these parts and the scrotum assuming, immediately after the extinction of life, a greenish colour and livid appearance, while the yellow tinge over

125. *e. That this distemper attacks the same individual only once*, a previous infection protecting the system more decidedly from a future seizure than even smallpox or scarlet fever from a second attack of these maladies, has been remarked by every experienced writer since Lining, and is an additional proof of the two propositions which I have endeavoured to establish, namely, 1st. That this malady is propagated, like them, by an infectious emanation or animal poison; 2d. That it is different from the more malignant forms of remittent or endemic fever, which is produced by terrestrial exhalations, which is non-infectious, and which attacks the same individual oftener than once, especially if he have had a change of climate after the first attack. Dr. James Clark, who had great experience of this malady in the West Indies during the latter part of the last century, and who has carefully distinguished it from the remittents of these islands, states, "that those who recovered of this fever were never attacked a second time, at least no instance occurred of it in our island, nor in any of the other islands, as I have been informed" (p. 19). The truth is, that no recent writer has denied this fact, excepting those who have confounded this pestilence with remittent fever, and who, having seen repeated attacks of this latter malady in the same person, and believing both maladies to be identical with each other, have fallen into the sophism of believing that what was true of the one was also true of the other. The protection afforded by a first attack, although recognised by several writers before Sir W. Pym, was never duly insisted upon and turned to a beneficial account, until his services were so usefully exerted in the early epidemics of Gibraltar. About the same time that he was acting upon this knowledge to the advantage of many thousands, the Spanish physicians also became aware of the fact, from observing that all those who had suffered from the distemper during former epidemics were not infected by it subsequently. Notwithstanding the numerous evidences of this important fact, adduced both in Europe and America, and by the French medical commissions, still the truth of it was disputed by the non-infectionists; for they believed, and believed truly, that the admission of it would be the surrender of one of the strongest positions which protected their doctrine. But the determination of this fact, so as to place it beyond the cavils of a party and the special pleadings of the prejudiced, was undertaken by Sir W. Pym at Gibraltar; and, notwithstanding the opposition of writers already passed into oblivion, is now established as one of the most undoubted truths in medicine. He acted upon it in Gibraltar in 1810, and was thereby enabled to cut short at once an incipient epidemic "He separated the first sick and the suspected from the healthy population, using, as his instruments of separation, those who had acquired the necessary immunity in some former epidemic. This proceeding now forms the basis of the sanatory law in Spain, and has been successfully repeated in Barbadoes, in 1821, by Mr. Green." (Sir D. Barry, *loc. cit.*, p. 97.)

126. *f.* Much, indeed the greatest part, of the numerous calamities of which this pestilence has been the cause has arisen from the manner in which the crews of ships have been disposed of in respect both of the appearance of it in ships while at sea, and of the communications of the crews and of their personal effects with the ports to which they are destined. Of the latter of these topics sufficient notice will be taken hereafter; but it will be necessary to the full consideration of the infectious nature of this distemper, that some notice should be taken *of its appearance in ships of war, in transports, and in other vessels.* I have perused most of the accounts of the outbreaks of this malady on board of ships to which references are made in the Bibliography to this article, and I have been particularly struck, not only by the very imperfect manner in which so very important a topic as the origin of the distemper on shipboard has been considered in most instances, but even by the neglect of it altogether, the reader being either left quite in the dark and to his own inferences, or he has intruded upon him various suppositions or false facts in the shape of foul ballast, bilge-water, chips, shavings, &c., which have been considered quite sufficient to account for the accumulated horrors which have been witnessed. Amid the numerous distressing details through which the reader who wishes to investigate the subject will be doomed to labour, he will find very few who impute this distemper to any other source than to the above, or to some other cause equally absurd, and quite as inadequate as they are to explain the results. Although the ships which have been the subjects of these dreadful visitations have proceeded very shortly before from ports in which this pestilence was prevailing, or have recently received persons on board from, or otherwise communicated with, these ports, or with other vessels containing cases of the malady, or even although they have been actually lying in the harbours of the towns where the pestilence was prevailing, still these writers could see nothing to account for the appearance of it on board the ships of which they had the medical care than some one of the supposititious causes now mentioned, which, even if

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the whole body was deepened. Black vomit was not so constant as the yellowness of the surface; but it occurred in the majority of the fatal cases. "On examination after death, even when black vomit had not occurred, the stomach was always found to contain that fluid; and, in all probability, in most of those cases that ended very rapidly, with but little gastric disturbance, dissection would have revealed the presence of that fluid in the stomach. This deadly symptom usually occurred on the third or fourth, sometimes on the second day." When the dark vomit came in contact with the patient's linen or sheets, it left a dark, indelible stain. In the endemic remittent of the island (he adds), "yellowness of the skin not unfrequently takes place, but is unaccompanied with that peculiar lividity of the neck, shoulders, and breast" which is so frequent in this pestilence; black vomit occurring very rarely in the endemic remittent.

To the above distinctions, Dr. Imray adds that this latter disease is seldom so sudden in its attack as the former, is usually ushered in by chills or rigours, and is marked throughout by distinct remissions and exacerbations; but in this pestilence, any sensation of cold was seldom experienced, either at the commencement of the attack or subsequently; and no remission was ever observed until the period of deceitful calm, when all pain and febrile excitement subsided. "This state, however, was never followed by an exacerbation, but seemed to proceed from loss of excitability and exhaustion of the vital energies." The above is a very correct and precise diagnosis of the two maladies, which have been so ignorantly, if not dishonestly, confounded with one another by so many writers against the infectious nature of the hæmagastric distemper.

proved to exist altogether in their fullest force, are quite inadequate to the production of the effects, often too weakly or too lightly noticed. Let any one who feels duly the responsibilities of the medical character read the accounts so frequently furnished us by the chief actors in the scenes which they describe—the statements of black vomit or yellow fever having broke out; of the greatest part, or the whole, of the crew having been attacked, and of nearly the half having died—without any rational explanation of the occurrence being attempted, without any idea of or reference to infection being entertained, without any evidence to show the absence of infection, or that it had not been introduced; and, what is still more monstrous, without any satisfactory attempt, or even without any attempt at all, having been made to limit the mischief, or to prevent the extension of the infection to the healthy; and having thus read the dry details of facts thus furnished him—facts barren as to the minds of most of the narrators, and of them only—let him then come to the conclusions, if he can, that all has been correctly observed and rightly inferred, and that measures of prevention have been sagely, or even at all adopted.

127. This pestilence appears in the crews of ships of war, or transports, or other vessels, and is readily recognised by the rapidity of the fatal result, by the black vomit, &c. The ships are at the time either in a port, or have recently left a port in which it was prevailing. One ship is provided with pig-iron ballast, and, therefore, as it cannot be viewed as the cause, bilge-water, or chips, or shavings, below the limber-boards, which generally exist in all vessels, are most logically inferred to be the cause of the distemper. Another ship has shingle ballast, and lo! the source of mischief is discovered. A third has neither shingle, nor chips, nor shavings, nor even bilge-water to furnish an explanation, and as the idea of infection cannot for a moment be tolerated by the very scientific surgeon, he therefore arrives at the very transcendental conclusion that the pestilence which has seized the whole crew, himself, and assistant, and killed nearly half, is nothing else than the effects of a "*ligneous principle*" developed from wood by a high temperature! While the men are dying like rotten sheep—in equal numbers and with equal rapidity with these not very sagacious animals—the commander is alarmed, all are amazed, explanations are required of the learned doctor, and in almost every case the reader will find that some one or other of the above causes is assigned by him. Infection suggests itself to common-sense people, and probably to the commander; but the unfortunate surgeon's common sense is overlaid, is smothered, by vicious authority and worthless writings. Besides, he thinks infection a "vulgar error," and its recognition below the dignity of science; or, if it intrudes itself upon his mind as the pestilence progresses, he feels that he has already committed himself, and cannot retract without practically exposing his ignorance. He therefore sticks to his explanation, even acts upon it, and afterward, perhaps, writes a book to prove his sincerity. All the while, as the imputed cause is supposed to have already produced all the bad effects that will ensue, either nothing is attempted to get rid of it, or, if any attempt be made, the measures connected with such attempt tend only to diffuse, or to concentrate the infectious poison, which either was not dreamed of, or not guarded against, nor in any way restrained nor counteracted. Indeed, on too many occasions the prevention of disease in the public service is considered beneath notice: it has formed no part of professional education; and when the information, which has been acquired chiefly with the view of passing an examination, has to be applied to great or pressing emergencies, the cure of cases as they rapidly occur is attempted by certain heroic remedies, while measures of prevention are either never thought of, or very imperfectly employed.

128. Now the reader may suppose that the above is an extravagant, an exaggerated statement of singular or rare occurrences, and of the notions which they have suggested to the very scientific observers. But let him peruse the voluminous writings on the subject, if he can command the patience or the temper necessary to the drudgery, and then let him decide. In some instances he will find it admitted that no cause for the evil could be detected in the ships themselves, and that, therefore, there was no cause for the existence of the pestilence; or, in other words, that the most terrific effects were produced without agents. They will, however, think that I am now actually doing the celebrated persons who have thus distinguished themselves a gross injustice by this statement; but they are themselves the perpetrators of the act. In Dr. Wilson's book on this pestilence he will find sufficient evidence to this effect. This writer has favoured us not only with his own opinion, but also with the official opinions of Dr. Bancroft, Dr. Adolphus, and Dr. Macnamara as to the appearance of this pestilence on board of certain ships of war. Now these physicians held the highest medical appointments in the West Indies; and, as we ought to find the highest amount of medical knowledge in the highest places, their opinions deserve respect—at least until we know them; but, unfortunately, after that knowledge is acquired all respect vanishes in spite of the most anxious efforts to retain it. As the reader may be fortunate in this respect, let him peruse the official reports of these physicians in Dr. Wilson's work (at p. 141–147); and let him endeavour to give as much credit as the amount of his credulity may permit to this writer's doctrine of the "*ligneous origin*" of this pestilence; for he avers that, if this origin be not admitted, "we shall be under the necessity of contemplating and endeavouring to counteract a disease regarding the origin of which we know nothing; we must look upon this sweeping pestilence as an effect without a cause, excepting such a cause as that *which smote the fourteen thousand Israelites in their tents.*" One would have supposed that, after this apparent endeavour to discover a cause, some attempt would have been made to show that the malady did not arise from infection or contagion, either directly or indirectly introduced on the occasions in question, before the "*ligneous origin*," or "*principle*," or *product not arising from dry-rot*—this something proceeding from wood, but not recognised by the senses—

this essence not seen, hut believed in, nor detected chemically or otherwise—this ignis fatuus so alluring to the doctor, yet so destructive to his patients—could have become the object of a devoted faith, of a firmly-rooted belief. But no such attempt is made; and although the ships of war were lying at Port Royal, Jamaica, when this pestilence first appeared in them; and although it is well known that it was more or less prevalent in this place, and in several of the ships in this port at the time, yet no notice is taken of the probability of infection having been conveyed on board the ships of war which were so terribly ravaged by it; and there does not appear that any attempt to prevent its introduction was made at any time. Indeed, on these occasions, as well as on most others, the adoption or non-adoption of measures of prevention rests with the commander of the vessel, or with the surgeon, under the sanction of the former; and where neither the one nor the other believes in infection, no restraints are imposed. It would appear from the official reports of the high medical functionaries above named, that they did not believe in infection. It is well known that Dr. BANCROFT has written voluminously, but it may not be equally well known that he has not written either candidly or truthfully, in disproof of infection. By the official reports on the ships of war at Port Royal, just alluded to, neither he nor his coadjutors have done themselves much credit. They have most entirely and most signally damned the cause they wished, at least professed, to support. Dr. BANCROFT furnishes, "*proprio Marte*," the most damaging proofs, the most conclusive evidence that could be adduced against that very doctrine which he attempted to establish by means of two thick octavo volumes of misrepresentations and special pleadings. Dr. WILSON would have deserved the thanks of all candid minds for the publication of a report which entirely destroys the most vicious doctrine—the most destructive in its consequences to the community—that has blinded the understandings of weak men, had he not at the same time attempted to rear a structure equally injurious, and even more unstable and absurd than the one which he has so completely overturned. But let me advert more particularly to the case of the unfortunate ships of war which called forth the reports of the above great West India authorities.

129. It should he premised that the infection of this pestilence had lurked for several years, or even longer, in the most frequented seaports of the West Indies, as Port Royal, the Havana, Vera Cruz, &c.; and as the inhabitants, especially those who have resided long in these places, have been once attacked, and are no longer liable to be attacked again, it follows that comparatively few are predisposed to the affection, excepting strangers or young persons; the arrival of a number of the former, particularly of persons from Europe, being followed, while the infection remains in the place, by an increased prevalence of the distemper. Hence the arrival of ships from Europe—whether ships of war, transports, or traders—and of troops from a different climate, is often very soon followed by an outbreak of this pestilence among them, more especially if no measures are taken, as too generally has been the case, to prevent the introduction of the infection, or to sequestrate those first attacked. The Iphigenia ship of war, while in Port Royal harhour, became infected with this pestilence. At the desire of the admiral, Drs. BANCROFT, ADOLPHUS, and MACNAMARA proceeded to examine her, and reported her clean, dry, and sound in every respect. They admit that the malady prevailing in this ship was this pestilence; and that it could "only he produced by an external cause," as no cause could be detected by them in the vesscl herself; but what this external cause might have been they appear to have been at a loss to imagine, for they summarily dismiss the idea of infection, without, however, adducing any evidence or argument against either the introduction or diffusion of the distemper by this cause. While thus drivelling respecting the existence of "*an external cause*"—this suspected entity or non-entity—the following statement is made by this sage commission: "We abstain, at this time, from offering any opinion as to the probable cause of the disorder [and this pestilence is only a *disorder* in Dr. BANCROFT'S estimation, the reporter of the commission] in the Iphigenia; though we think it right to state that we have not hitherto found evidence sufficient to authorize the belief that her anchorages in the harhours of Curaçoa, off Puerto Cabello, or Port-au-Prince, within the last five months, at all contributed to produce the fever." Now what is here aimed at? They assert there was no internal cause or source of mischief; that hence there must have been an external one; but that this external one was not derivcd from the harbours just mentioned: they, therefore, would seem to infer that it existed, or was derived, from the port where this ship was now lying. But Dr. ADOLPHUS comes to this conclusion, in a separate document. "I consider the fever (in the Iphigenia) to have been produced by increased temperature and other atmospheric causes;" and here he stops without a single word heing added. This, thcrefore, we must consider as his "external cause." Dr. MACNAMARA next enlightens us with his "external cause," also in a separate document of most palpable absurdity. Here it is: "It is difficult to account for the gcneration of disease in a ship so well regulated, and in such a state of high discipline as the Iphigenia; and I am most positively and decidedly of opinion that the disease, which has already committed such ravagcs on board that ship, is to be solely attributed to a particularly vitiated state of the atmosphere, the influence of which has been experienced along the whole of the American coast, from the northern bank of the Orinoco to Boston in New-England, and in the adjacent islands." How precisely this vitiation of the air, this arch assumption, is limited! What countless crews of ships must have suffered, what interminable wretchedness on shipboard, and on coast-board also, must have been produced by a "particularly vitiated" air, extending from the Orinoco to Boston, inclusive of the West Indies, &c. How few could possibly have escaped destruction, seeing that the air which all within these extended bounds must have breathed was, in the "positive and decided opinion" of Dr. MACNAMARA, in "a particularly

vitiated state!" What a loss science has sustained in having had the particular vitiation in question, so decidedly and yet so precisely extended, left entirely unexplained, and its nature unascertained! But this deficiency may have been subsequently supplied, and the document supplying it may be buried in the rich repositories of the Medical Board and Somerset House. The reader has now got the opinion of the majority of the commission as to the mysterious "external cause" of this fever. What Dr. Bancroft's opinion is does not appear. Probably his experience as to his former opinions make him more reserved on this occasion, and he comes into the field fortified by the caution of an old soldier.

130. The crews of ships of war, transports or traders, are rarely the subjects of fever in the West Indies, unless they are exposed to the infection of this pestilence in the ports where it is prevailing at the time, or have the infection introduced among them from these ports or from infected vessels. They are rarely in that country exposed to the malaria proceeding from marshes or lagoons, unless when watering, or when allowed to remain on shore, and then they readily are attacked by remittent fever, especially if they have slept within the sphere of these sources of disease. The pestilential fever now under consideration has appeared on board many vessels whose crews have not been exposed to these sources, and not a few of these have been ships of war which were certainly not so exposed. Nevertheless, attempts have been made, although most fruitlessly, to show that the causes of the distemper have existed in the ships themselves; either the ballast, or the hilge-water, or the wood itself of which these vessels were built, having been imputed as the cause, without the least endeavour to prove any thing actually noxious proceeding from any one of these sources, or to demonstrate the generation of any gas from them, whereby the air could be vitiated. Ships of war are now, and have long been, provided with iron hallast and tanks, so that the chief source to which the non-infectionists imputed the distemper did not exist in them; and yet we find that many ships of war have had their crews nearly altogether carried off by it; and although the introduction of infection might have been presumed, owing to the remarkable probability of such an occurrence, these vessels either being at the very time in infected ports, or very recently having left such ports, or having communicated with infected vessels, yet no satisfactory inquiry was ever instituted by the surgeons of these vessels to determine the question as to the propagation of the malady from these sources; the only inquiry that was made being that respecting the conditions of these vessels as to cleanliness and discipline. The probability, or even the possibility, of infection was not dreamed of; indeed, many of those to whom the matter more especially appertained, would neither see nor admit infection under any circumstances, neither the word nor the meaning attached to it being comprised within the limits of their belief. Take, for instance, the following:

131. The distemper existed at Port Royal, in Jamaica, both previously and subsequently to the arrival of the Rattlesnake ship of war there, in July, 1824; this vessel being clean, sweet, well ventilated. Dr. Wilson, the surgeon of her, admits that he was himself the first who was attacked; and that he, as well as the purser, was seized "*from exposure to the cause on shore.*" Indeed, there can be no doubt of both of them having contracted the disease on shore, for Dr. Wilson admits this in no less than two places at p. 159 of his book, written to prove the "ligneous origin of the distemper." And there is as little doubt of their having introduced the infection on board this vessel, although he argues against the existence of infection, but without furnishing any proofs of his position; the efforts to infer the non-existence of this property obviously originating either in a desire to establish his own hypothesis, or in the consciousness of having neglected measures to prevent the diffusion of infection—a diffusion fatal to a large proportion of the crew. The following are facts which cannot be refuted.

132. First: this pestilence prevailed at Port Royal, more or less, for several years, about this epoch, namely, from 1819 to 1826; but the doctrines of Bancroft and other non-infectionists were exerting a most noxious influence over the minds of medical officers in the public services in the West Indies. Owing to this circumstance, no measures were taken, with few or no exceptions, among either the military or the naval forces, to prevent, to limit, or even to restrain the spread of infection. The only restraints which were attempted, and these but few, were owing to the good sense of commanding officers. During this period the crews of many ships became infected with this pestilence at Port Royal; but the surgeons of these ships, with the exception of the surgeon of the Scout sloop of war, were blinded against infection, and had some favourite hypothesis to support.

133. Secondly: the Rattlesnake having thus arrived at Port Royal, where the distemper existed, communicated with that port; the officers who first went on shore were the first attacked by it; and nearly the whole of the crew were afterward seized, at first gradually, but subsequently much more rapidly; for the ship having put to sea under a false impression as to the cause of the malady, and bad weather having come on, and occasioned the shutting of the gun-ports, &c., thereby preventing due ventilation, the distemper spread with greatly increased rapidity and fatality. These are the facts respecting this ship of war, and they cannot be gainsayed by any special pleader.

134. Thirdly: but in these fatal years, other ships of war arrived during the years 1824 and 1825 at Port Royal, and suffered in a similar manner to the Rattlesnake. The Isis ship of war arrived at this port in 1824, and this distemper appeared on board of her in October. She was ordered to the Gulf of Mexico, where the prevalence of north winds at this season reduces the temperature to about 65°, or even lower, and the disease subsided. This ship returned to Port Royal in the following autumn, and the malady reappeared in her, and was very destructive. In this year the Lively, Pylades, and Ferret were half unmanned while lying in this port; and other ships were simi-

larly infected. But the calamitous consequences of a general indisposition on the part of medical officers to admit the existence of infection were not limited to the naval service. The military medical officers, with the Coryphæus of non-infection then at their head, were equally blinded to every perception of the property to the non-admission of which the lives of thousands were sacrificed. Stoney Hill, in Jamaica, is situated 1300 feet above the level of the sea, and would be healthy for troops if precautions against the introduction of infectious fever were duly instituted. The seventy-seventh regiment arrived in Jamaica in 1825, and was stationed here. This pestilence appeared among them, and, no satisfactory means of preventing its spread having been taken, it attacked nearly all, and carried off a very large proportion. It should be, moreover, recollected that the greatest prevalence of the distemper on shore among the military, and among the inhabitants of Port Royal who were not protected by a previous attack (for this protection and its influence should not be lost sight of in the argument), was in the very year and season of its most destructive prevalence also in ships arriving at this port.

135 The surgeon of the Scout sloop-of-war sent home documents proving the contagious nature of this distemper on board of this ship; and Dr. J. Johnson, whose belief in this property appears to have been very limited, or contingent, as he terms it, states that he "had seen these documents, and can vouch for the highly contagious character of the fever." (*Med. and Chirurg. Rev.*, vol. ii., p. 12.) Now, if admitted to have been contagious in the case of this ship, and likewise in the case of the Bann, as demonstrated by Sir W. Burnett, the able and zealous head of the naval medical service, how comes the same identical malady to be non-contagious on board of other vessels placed in similar circumstances to these, in which others it has been even more general and more fatal? Surely, if in about a dozen ships of war the same distemper appears after arriving at a certain seaport where that distemper exists, and if it be admitted by one from whom the admission is almost extorted, that it was actually contagious in one of these ships, it could not be less contagious on board of the other ships which had arrived at the same port, which had been infected from the same source, and in which it was even more fatal than in the one to which the contagion is conceded. This is a matter which concerns the lives, not only of the crews of ships, but also of regiments, of armies, and of the inhabitants of populous cities and towns; and yet it has been allowed, up to the present day, to be disposed of, and measures, or rather worse than no measures, have been permitted to be taken respecting it, in our numerous colonies and dependencies—in our fleets and in our armies—according to the visionary notions of the totally inexperienced, and of those altogether unacquainted with the nature and cause of the pestilence in question; or, what is still worse, to those who have formed erroneous notions respecting its source and properties. What can be the use of accumulated facts and of countless observations to prove that which requires no farther proof, if they are not to furnish data from which correct inferences are to be drawn for the benefit of the inexperienced, for the direction of the wrong-headed, and for the advantage of the general community, by those competent persons it is to be presumed to whom these facts and observations have been officially furnished? And possessing these data, should it not be required that such inferences shall be drawn by minds capable of weighing evidence and of devising rational expedients of protection, that these inferences might be made the basis of instructions for the institution of salutary measures for the guidance of the uninformed and the unthinking, and for the strict observance of the reckless and the vain theorizer, in order that hundreds of thousands of human lives may not be sacrificed to the Moloch of false doctrine, as they have been during a long series of years.

136. *g.* Let the occurrences at *Sierra Leone* in 1823 and 1829 be taken as a specimen of the mode of medical protection from pestilence in a colony most liable to outbreaks of it, although provided with a colonial surgeon, a deputy inspector of hospitals, and with other medical officers. This distemper has appeared at this place also in other years; but the colonial surgeons and deputy inspectors have written on the occurrences of these years, and books and reports have been the results of their Sisyphian toils. The governor of the colony, however, has thrown light upon a subject which they have confused and mystified; and has shown, as respects the epidemic of 1829, that it was imported into the colony, and that it was highly contagious both there and among the shipping. (*Narrat. of the Ashantee War, and Present State of Sierra Leone*, &c. By Major Ricketts, Governor. 8vo, Lond., 1830.) The medical writers on those epidemics—for they cannot be called authorities as regards this malady, unless they be viewed as such against the doctrine which they toil so ineffectually to support—found that a distemper which they recognized, after a time, as altogether different from the endemic of the country, had come among them; but they were quite unprepared for the occurrence, notwithstanding the records and recollections of former visitations. They appear at first to have mistaken the malady for the endemic of the country, and when their eyes were opened they were amazed and alarmed, and they acted as they have written, in a state of imbecile confusion and bewilderment. Their accounts are full of contradictions. While they argue against infection, they, in the unconsciousness of helpless ignorance, furnish the most conclusive evidence of the existence of this property. They admit that the persons attacked first in the colony had visited a place in the vicinity, two or three days previously, where the pestilence was then raging, yet they deny the existence of infection, and issue notices to prevent the adoption of precautions against the spread of the distemper, at the very time when such precautions ought to have been taken under their directions. They admit the identity of the malady on shore with that on board of several ships in the roadstead, and of both with the pestilential yellow fever, and yet they contend that it was altogether non-infectious in the former, and infectious in the latter! Their admission of this property in the ships was evidently extorted from them by undenia-

ble facts, and the firm belief of every rational and unprejudiced mind; but no measures of protection were proposed by them.

137. The *source* of the distemper might have been readily ascertained in both these epidemics, if the inquiry had been instituted by competent, candid, and unprejudiced persons. Indeed, in their unfortunate endeavours to mystify the matter they sufficiently indicate the source, although without the precision and force which might have been imparted to it by positive evidence. Still, the admissions of infection which escape their powers of concealment are, perhaps, the strongest proofs of the fact that could have been adduced. The infection having been introduced without having been recognised or suspected, until its mischievous effects had proceeded far, by those whose duty it was to watch for, to detect, and to guard against it, their secret yet manifest desire was to deny its existence, and to suppress, misrepresent, and distort occurrences and circumstances accordingly. Although persons belonging to the colony had visited places adjoining where the pestilence was raging at the time, had returned to the colony, and were immediately afterward attacked and died, other cases of the disease following upon these admitted to have been the first; and although ships, more especially slave-ships with sickly cargoes of human beings, arrived at the colony just before and at the time of the outbreak of these epidemics, some of the writers on the subject contended that the distemper had arisen from malaria brought from a distance by the winds, and others concluded that it had travelled from the interior of Africa to the coast—a sufficient admission of infection; while the more observant of the residents believed in its introduction through one or other of the channels just indicated, or through both. There can be no doubt, however, that the distemper was conveyed in 1823 on board of the Bann ship of war, then at Sierra Leone, where it was prevailing both on shore and in the shipping, either from one of the slave-ships detained at Sierra Leone, or from a trading vessel at that place; that the crews of the Bann and of the San Raphael, a tender to and accompanying the former ship, were generally attacked, a very large proportion having been carried off on the voyage to the Island of Ascension, from Sierra Leone; that the pestilence was introduced by these ships into that island, where every one was seized, and many died of it; that the Driver sloop of war arrived in perfect health at this island, where a very restricted communication took place between her and the Bann; and that three persons "were taken ill with the prevailing fever, two of whom were sent on shore, and one died on board; and the captain very properly put to sea and used every precaution; and with these three cases the disease ceased." (Sir W. Burnett's *Official Report of Sickness*, &c., *in the Bann.*)

138. While the pestilence was prevailing at Sierra Leone in 1829, the Eden and Champion ships of war left that colony for Fernando Po, and immediately upon their departure it appeared and ravaged these vessels, all the medical officers, five in number, having been attacked, three having died. When the ships reached Fernando Po they had lost about half their crews. At this latter place communication took place between the crews of these ships and of the Sybille, the Hecla, and Black Joke; and the distemper appeared also in these ships, and became most destructive. These facts cannot be disputed, and whatever attempts may be made to explain them away by self-sufficient cavillers, they will still remain remarkable indications to all common-sense persons of that very important property of the distemper upon which every means of preventing and of restricting its propagation should be based; and to the neglect of which so much misery has been inflicted upon extensive communities, both civil and military, up even to the present day. During the continuance of this epidemic the crews of several trading vessels were nearly altogether swept away. Every person on board of two ships was attacked, and only two survived. This frightful mortality appears to have been mainly attributable to erroneous notions entertained by the medical officers of the colony as to the cause of the distemper, and to the neglect of every precaution against it, and of all means calculated to prevent its extension. Their minds were preoccupied with one idea, and were incapable of conceiving another. This single article of their faith and belief was malaria; it was their evil genius which distorted their vision, disordered their understanding, perverted their judgment, and rendered them altogether incapable of meeting the crisis which their incapabilities had tended to develop. Malaria, according to them, was in the winds, in the waters, in the earth, and in the regions under the earth; and yet it did not, they believed, originate where it was so mischievous, but was brought from a distance on the winds, and even over the extensive bay into which the Sierra Leone River empties itself. To this absurdity they joined a second, namely, the belief that a distemper of a continued and rapid course, such as they observed and described, could proceed only from a cause always producing effects of a very different character.*

* While the foregoing pages were passing through the press, the author received the official returns to Parliament respecting the disease which prevailed, in September, 1845, on board the "*Eclair*," steamship of war, on her return to this country from the coast of Africa. The conveyance of this pestilence to the very shores of Great Britain—almost to the portals of the metropolis—and the alarm of the public mind consequent upon the circumstance, gave rise to the correspondence and documents on the subject which have been printed, and from these the following particulars are derived:

The "*Eclair*" steamship left Plymouth on the 2d of November, 1844, with a crew of 146 officers and men. On the 20th of December she was at the River Gaboon, on the west coast of Africa, and passed thence westward and northward along the coast until she arrived at Sierra Leone on the 23d. She there took in 40 Kroomen and liberated Africans, allowed to assist the crew. She departed from Sierra Leone on the 28th of January, and continued off Sheerboro, watching slave-traders, until the 4th of February. During this time the vessel could not have safely approached nearer than three miles to the shore, owing to the shelving nature of the coast; but the boats were sent in, and the men landed frequently, and slept on shore on two or three occasions. Most of the men who had slept on shore were attacked with fever, which appeared to have been of a malignant kind, as nine or ten of those attacked died; but two of the men who were severally seized had not been out of the ship. These cases occurred during the months of April, May, and June, and were said to have been the endemic remittent of the climate; but no details of symptoms are given. When the vessel returned to Sierra Leone, on the 4th of July, the crew was healthy; but, from that time until her departure on the 23d, the men were engaged in cleaning out the hold

139. *h.* From what has been advanced above it may be admitted without any assumption,

1st. That this pestilence is altogether different, in its causes, progress, and nature, from every form

of the "Albert" iron steamship, and were allowed to go on shore; and several of them slept on shore. Of these, four were attacked with fever on the 19th, 21st, 22d, and 23d; one was landed, but the other three were treated on board and died. No account of the symptoms are given. But Sir William Pym, who went on board on the arrival of the "Eclair" in England, and examined the officers, states that the first man who died after leaving Sierra Leone on the 23d had black vomit, and that the cases which occurred then and subsequently, as well as those which were still remaining, were actually this pestilence. On this point it is impossible for Sir William to have been mistaken; seeing that his experience of this distemper in the West Indies and in the south of Spain has been greater than that of any other physician whatever; and, although no description or details are given in the official papers now before the author, yet quite sufficient is stated to show the nature of the distemper.

The "Albert" was taken in tow by the "Eclair," and brought into the Gambia on the 10th of August. After leaving Sierra Leone, three other men were attacked in the end of July, and died; these men had also slept on shore; and a merchant who embarked on board the "Albert" at Sierra Leone was also taken ill in that vessel, and died on the 27th of July. The first three of those attacked in August were on board of the "Albert" when taken ill. "Afterward the fever became indiscriminate in its attacks." The "Eclair" touched at Goree to take in coals, but was not allowed pratique. She went on to Bona Vista, one of the Cape de Verd Islands, where she arrived on the 21st of August, having had, from leaving Sierra Leone, eighteen men attacked by the distemper, and of these thirteen died, most of them with the black vomit.

At Bona Vista the disease continued to spread rapidly among the crew, when, permission having been obtained from the Portuguese governor, it was determined to land the crew, sick and well, and purify the vessel. A fort was appropriated for the accommodation of the seamen and sick, and the officers obtained lodgings in the town. Every means were taken to purify the ship by washing and whitewashing, fumigation, &c.; all the Kroomen remaining on board, with the exception of six employed in attendance upon the sick. The disease, however, continued to prevail among the officers and men on shore, thirty-one men having died between the 21st of August and the 13th of September. Under these circumstances a consultation was held by three naval surgeons, and upon their report and recommendation it was determined that the steamer and crew should proceed to England. The ship's company were in consequence reembarked, and sailed on the 13th of September; Captain Estcourt having been taken ill the day before leaving Bona Vista, and died on the 16th. At Bona Vista the Assistant Surgeon Harte, of the "Eclair," died, when Dr. M'Clure, a naval surgeon, passenger in the "Growler," and Mr. Coffy, assistant surgeon of the "Growler," volunteered their services on board; here, also, seven seamen volunteered from the "Growler." Dr. M'Clure died on the voyage to Madeira, and one of the volunteer seamen was taken ill of the fever and recovered. Upon the arrival of the steamer at Madeira the authorities refused permission to communicate with shore, as had been previously done by the French at Goree; but at this island Mr. Barnard, a naval surgeon, volunteered his services, and was received on board with two seamen. From the day of her sailing from Madeira, the 21st of September, up to the 30th, seven deaths had taken place from the fever, and eight new cases had occurred.

On the passage from Bona Vista to England forty-one were attacked, and twelve died. In the short time of the vessel's remaining at the Motherbank two men were seized and died. From the time of her being put in quarantine on her arrival until the 31st of October, nine new cases occurred, five of which were fatal. The pilot, who was taken on board on the 1st of October to take her to Standgate Creek, was taken ill on the 7th. An officer was also seized on the same day, and both officer and pilot died in three or four days. The surgeon was taken ill on the 4th of October, and the assistant surgeon on the 5th; the former died. The illness of the two surgeons occasioned the sending two other medical officers, on the 5th, on board the "Eclair," and one of them was attacked on the 11th. After this period but slight illnesses occurred, and the disease entirely ceased soon afterward, owing to the arrangements made under the directions of the quarantine establishment, aided, most probably, by the low range of temperature at this season, and in this climate.

There appears to have existed in the minds of the medical officers attached to this vessel a strong belief that the distemper, which was so fatal, was merely the endemic remittent of the African coast. As such they reported the disease, and hence were allowed, with great hospitality and kindness, all the advantages which could accrue from visiting Bona Vista; and yet, when they drew up their report advising the return of the vessel to England, the three medical officers concur in characterizing the distemper as "a malignant fever," causing "great mortality;" and in stating that "many fresh cases were daily occurring;" and they farther add, that "the extremely malignant character of the fever, *which has resisted the treatment usually found successful in the common endemic fever of the coast*, its continuance since the removal of the 'Eclair' from the coast, &c., induce them to recommend the return of the vessel to England;" a resolution most proper in the circumstances; but the very terms in which the recommendation is worded show a tacit consciousness that they had not the endemic remittent of the climate to deal with. That the distemper was genuine hæmagastric pestilence, is shown by the very few particulars furnished by the printed papers as to the appearances and symptoms of the distemper. I state this from my experience of this pestilence and of the endemic remittent of the coast of Africa. Dr. Stewart, in his medical report of the few cases which came before him after the 7th of October, when he joined the "Eclair," mentions "black vomit and slight yellowness of the skin, which became of a deeper shade after death. In the second case there was hiccough during the last fifteen hours of life, and with the hiccough a plugging, guggling sound, which conveyed an assurance, that had it been possible to examine the stomach after death, coffee-ground fluid would have been found in it. There was a slight tinge of yellowness in that case, also, during the last hours of life; and after death the body became very yellow, while the neck was as dark as if the patient had been strangled." (P. 90.)

That an infectious fever had been introduced into this vessel, and that it spread by infection to all who were attacked, are proved by the history of its progress; by the extension of it to all but one of the medical officers who attended the sick, and the death of most of them; by the introduction and spread of the pestilence to the inhabitants of Bona Vista; by the infection of five of the Kroomen, or native Africans, who are exempt from remittent fever, but not from this pestilence, although they are little subject to it; and of the persons who went on board the vessel after her arrival in England; and by the "fact of the sick attendants from the 'Worcester' getting fever after returning to the 'Eclair.'" (P. 90.)

In farther proof of the above, it may be added, that of four officers of the "Growler" steamer sent to survey the purser's stores on board the "Eclair," three of them—the lieutenant, purser, and clerk—were attacked in consequence, and several of the crew; "in all thirteen cases; and two of the three last cases died at Woolwich with all the symptoms of the disease." (P. 77.)

It now remains to notice what occurred at Bona Vista after the departure of the "Eclair;" and, in doing this, it is necessary merely to furnish abstracts from the official reports of the British consul and of H. M.'s commissary judge to Lord Aberdeen. Consul Rendall states, that the "Eclair" was allowed pratique, and permitted to land her crew at Bona Vista on the representation of the medical officers that the cases of fever which had occurred on board were the endemic remittent; that black vomit had not been mentioned; that, seven days after the steamer had left, one of the white Portuguese soldiers who had been housed with the crew of the "Eclair" died in the fort (which had been given up to the crew); that on the following day another also died, and the remaining soldier in the fort (a coloured man) was reported sick; that another coloured soldier, sent to assist his comrade, was also taken ill; and that the authorities therefore abandoned the fort and island, and caused the two sick men to be brought into the town. The distemper then began to spread, and the first fatal case in the town occurred in the house where the two coloured soldiers from the fort had been brought and recovered from their sickness. "Up to the first week of December the fever continued to rage, and at that period it had found its way into almost all the country villages, the deaths averaging seven or eight daily." "The English have suffered considerably, having lost one third of their number," and among them the resident English surgeon, Mr. Kenny. The symptoms were black vomit, pains in the head, back, and thighs, with suppression of urine, and sometimes hæmorrhage. The consul adds that the fever had proved contagious to those who acted as nurses to the sick; this was observed to be the case without exception.

The commissary judge, Macaulay, in his letter to Lord Aberdeen, after remarking the usual healthy state of Bona Vista, and the introduction of a malignant fever into it by the "Eclair," notices the improper conduct of the medical officers who had reported the disease to be merely the endemic remittent of the coast, while it was obviously a malignant and fatal pestilence; and remarks that these officers, not having "previously served on the African station, had mistaken the malady," declaring from first to last that

or grade of remittent fever; 2d. That it is infectious in its nature among the predisposed, and more especially in a warm, humid, and close atmosphere; and, 3d. That it attacks the human frame only once, the exceptions to this being even fewer than in respect of any other infectious malady.

[Professor Dickson lays down the following propositions, as containing all that is clearly known in relation to the generation of yellow fever:

"1st. This malady is the effect of a specific and peculiar cause.

"2d. In certain localities, this obscure cause is permanent, and always active; in others it exhibits only an occasional activity, by which alone its presence can be inferred. In Vera Cruz, Havana, and Kingston it is perennially endemic; it is occasionally so in New-Orleans, Mobile, Savannah, and Charleston, which last city seems to be placed upon its extreme northern limit of spontaneous production.

"3d. Its relation to season and temperature is equally well made out, being efficient only during the hot months of summer and autumn.

"4th. Yellow fever is contagious; in other words, a case of yellow fever having been generated in a favourable season and locality, by its unknown and undetected cause, becomes itself a generating centre productive of other cases, or of a morbid agent capable of producing them.

"5th. It is transmissible from any one centre to another, or from any one of its generating centres to a healthy locality; and this communication or extension may take place in two modes: either by conveyance of a portion of atmosphere, in which is diffused its undefined specific cause, as in the hold of a foul vessel, from any place where it prevails epidemically; or by the introduction of a sick body or any fomites imbued with its own contagion.

"6th. As a general rule, the contagiousness of yellow fever is limited by certain contingencies. This is Hosack's doctrine of contingent contagion; but the same circumstances limit the efficiency, also, of the generating cause, as, indeed, of all the alleged causes of yellow fever. Thus, high temperature is necessary to its production, existence, and extension. A depraved atmosphere, whether koino or idio-miasmatic, is generally, but not always, essential to the spread of the disease. The chief contingency on which its extension prevails, besides heat, is density of population Originating in any one spot, it spreads thence not only by conveyance, but by infected atmosphere, widening its sphere of influence gradually on all sides, until it takes in the whole limit of a dense or concentrated population, but losing its force as soon as it reaches an atmosphere free from concentrated animal effluvia." (*Essays on Pathology*, &c., vol. i., p. 340.)

The apparent anomalies observed in connexion with the mysterious spread of yellow fever may, as Professor Wood remarks, be explained by one of two theories. According to one of them, a peculiar product is generated, under certain circumstances, which is capable of acting as a ferment, when it finds the proper materials to act upon, and of reproducing itself, or a substance identical with it, out of these materials, as yeast is generated during the vinous fermentation which it has set in motion. The other theory supposes the cause to be a living, organized, microscopic being, either animal or vegetable, which, produced out of pre-existing germs, under favourable circumstances, is capable of propagating itself indefinitely when these circumstances exist. According to either of these views, the ferment or the developed germ may be conveyed in ships, or even in the clothing of individuals, from one spot to another; and, if it find the proper material to act upon, or the proper food to support it, with the temperature essential to its activity, may spread itself indefinitely, and, though perhaps originally little more than a mere point, may poison the atmosphere of a whole city. Thus is explained the conveyance of the disease from place to place, without the necessity of appealing to the medium of contagion. That it is not more frequently propagated to interior cities, may be owing to the less likelihood of the conveyance of the poison in the clothing of an individual than in the confined air of ships, where it may possibly be kept in existence by the same power of propagation. In favour of the theory which ascribes the disease to organic germs, is the fact that it is endemic or original only in a comparatively small portion of those regions of the world where all the exterior circumstances would appear equally to favour its production. Organic germs have been planted by the Creator in certain parts of the earth; and that of the cause of yellow fever, supposing it to be organic, may have been originally limited, by the same fiat which produced it, to the warm latitudes of America. That it has reached Philadelphia and New-York, upon this continent, and Gibraltar and Barcelona upon the old, rath-

it was nothing but the common coast fever. He farther adds, that Mr. Mantell, the queen's advocate, who had come from the Gambia to Bona Vista in the "Eclair," first mentioned the occurrence of black vomit in one of those who had died on the passage from the Gambia; but that the medical officers would not admit that any importance should be attached to this circumstance; and he concludes his letter with the same account as the consul has given, of the infection of the soldiers from the crew of the "Eclair," and of the population of Bona Vista from the former (see above). The latest published accounts state the number of deaths in this island to be upward of 400, and the distemper still prevailing.

I cannot refrain from directing attention to the evils which have resulted on numerous occasions, and even more flagrantly and flagitiously than on this, from the confident tone so often assumed by very young and quite inexperienced medical officers of the non-infectious nature of the distemper under consideration, and from the circumstance of their confounding it with the endemic remittent. These false notions are mischievous enough even when entertained by theorists and speculators after popularity with money-getting traders, who view restrictions requisite to the protection of public health as invasions of and abstractions from the amount of their private interests and gains; but they become ten-fold more destructive when they are made at the caprice or upon the hasty suggestion of an inexperienced and reckless young surgeon, the basis of measures involving the lives of thousands. Why, in the name of all that is honourable and humane, among the regular members of our profession—and we believe, as yet, none but such can gain admission into our public services, although such limitations may not be observed in palaces or courts—are not definitive instructions furnished by the heads and boards of the medical departments of the public services, which may guide the inexperienced in devising precautions against the extension of malignant and pestilential distempers when they first appear in ships, garrisons, and armies. The votaries of medical science would, in their simplicity, believe that such ought to be one of the chief functions of those boards; but, alas! this at least does not appear to have hitherto been one of their offices.

er than the more distant ports of the Mediterranean or the East Indies, may be owing to the less mercantile communication of the latter with the places of its production, or simply to their greater distance. (*Treat. on Pract. of Med.*, vol. i., p. 306.) We believe that the spread of yellow fever may be more satisfactorily explained on either of these theories than on that of abstract contagion, as held by our author.]

VII. Of the Origin of this Pestilence.—The next *topics* which may require a brief consideration are those involved in the following questions: *a.* Can remittent fever, or fever proceeding from malaria under circumstances of crowding, insufficient ventilation, and a high range of temperature, change its character, and become this distemper?—*b.* Can the accumulation of the sick of other diseases in a close, hot, and humid air, give rise to this pestilence, or generate its seminium?—*c.* Can the accumulation of a number of persons in similar circumstances, and more especially of a large number of negroes in the close hold of a slaveship within the tropics, so contaminate the air as to occasion, or otherwise generate, the distemper, the pestilence being thus produced *de novo*, whenever any of the foregoing circumstances exist in a marked or decided manner?—*d.* Does this malady ever arise *de novo* from the decomposition of accumulated animal excretions or exuviæ, or of dead animals in a warm, humid, and still atmosphere; or from exhalations from foul or obstructed drains and sewers during states of the air favourable to their concentration?—*e.* And, lastly, is this pestilence propagated only by a specific cause, like to smallpox or scarlet fever, that may be preserved for a considerable time in *fomites*, during circumstances unfavourable to its outbreak, but may occasion it as soon as those circumstances supervene which favour its operation, viz., a high temperature and a humid and still atmosphere?

140. *A. Can remittent or periodic fevers proceeding from malaria so change their characters and properties under circumstances of crowding, of insufficient ventilation, and a high range of temperature, as to become this distemper, and to assume infectious properties?*—The solution of this question is by no means easy. The evidence bearing upon it is probably insufficient to prove the negative; but most certainly we have no satisfactory proof of the affirmative. The occasions certainly have not been few on which a large number of persons affected with remittent or other periodic fevers produced by malaria, have been confined in close apartments, or otherwise placed in circumstances favourable either to the evolution of a new character in these cases, or to the production of a distemper with different properties from those attending the pre-existent malady; and yet I can find no satisfactory evidence of such conversion of disease having occurred within the tropics, or in more temperate climates, during hot seasons. I cannot deny the possibility of this conversion; but I have not met with it on two or three occasions of this description which have fallen under my observation; and, although it has been contended for by several very respectable authorities, still the evidence in favour of it is not conclusive. In order that the necessary elements of sound conclusions should be furnished respecting it, the proofs of malaria and of its consequences, periodic fevers, should be adduced; and evidence of persons holding communication with others affected with those fevers in a warm, humid, and close air, becoming infected with this distemper, no other source of infection existing, ought to be furnished. The existence of remittent fever and its origin in malaria, the actual conversion of the remittent fever into the true hæmagastric infectious pestilence, and the circumstances connected with this conversion, should be fully and unequivocally shown; or, in other words, the assumption of the properties of the latter by the former, under the circumstances just specified, and the propagation of the assumed properties and converted malady, thus originating *de novo*, in a similar way to other manifestations of this pestilence in an epidemic form, ought to be satisfactorily demonstrated. I cannot, however, satisfy myself, after the diligent attention I have devoted to this topic, that these premises are so established as not to admit of doubt. We do not find in the eastern hemisphere, where remittent and other periodic fevers are prevalent, and where the occasions favourable to the conversion of them into this pestilence are as likely to occur as elsewhere, that such conversion has ever taken place, for there this pestilence is unknown. During the late Niger expedition, the occasions favourable to the conversion of the remittent fever into this pestilence must be admitted, and yet I know that this conversion—that this pestilence, did not result. Similar facts have fallen under my own observation.

141. This doctrine of *contingent infection* owes its origin chiefly to the fact of remittent fever in its worst forms having been so frequently confounded with this pestilence, and to the circumstance of the infectious nature of the latter having been so fully demonstrated as to preclude skepticism, while the belief in malaria as the original cause was still adhered to. But the undoubted and now generally admitted fact, that this pestilence attacks the same individual only once, strongly militates against the conversion in question, and against the *contingent origin* of infection, while it strongly supports the doctrine of a specific cause of the malady, different from, and independent of the causes productive of periodic fevers. That the conversion of these non-infectious fevers, under the favourable circumstances mentioned above (§ 140), into the hæmagastric pestilence, which is afterward propagated by infection, may be *possible*, I will not attempt to deny. I, however, believe it to be very *improbable*. I know that my own observation and research have not furnished me with any evidence of its occurrence that can be implicitly relied upon; and hence that conclusive proofs of the fact are still required. Besides, most of the outbreaks of this pestilence have commenced by solitary cases, without any instances of remittent fever having then existed in the locality or vicinity, and without any communication having been known between those first attacked and persons labouring under remittent fevers.

[It is doubtless true that the yellow fever attacks an individual but once in any of its endemial seats, provided he remain there a constant resident; but let him remove to a colder

climate and spend but a single winter, he will again he liable to a re-attack on visiting a tropical climate. "There is much dispute," says Dr. Dickson, "whether a Gibraltar or New-York attack will save a man from a second in Havana or Vera Cruz, or even in a subsequent epidemic visitation after a long interval. I believe the security in these latter cases less perfect, but I cannot help regarding it as still very notable, and fully proved." This protection is evidently, then, owing to the influence of acclimation, and therefore does not have an exact analogy to that observed in smallpox and measles. It is very doubtful whether one attack of yellow fever in New-York or Boston would render a person insusceptible to another attack in the same locality. All, then, that can be affirmed, in the existing state of our knowledge on this subject, is, that long residence in a warm and tropical climate, and a previous attack of yellow fever, secure the constitution for the future.]

142. *B. Can the accumulation of the sick of other diseases in a close, hot, and humid air give rise to this pestilence, or generate its seminium?*—What I have stated in answer to the former question also applies to this, and even with still greater force. Without, however, denying the possibility of such an occurrence as that involved in this question, I cannot find sufficient proof of the fact. Moreover, as this distemper possesses certain specific properties analogous to those of other infectious fevers, arising also from a specific cause—as it, like scarlet fever, measles, and smallpox, presents regular stages and periods; attacks the same person only once, and spreads among the unprotected by means of an effluvium from the bodies of those already affected by it under circumstances favourable to the concentration and operation of that effluvium—so it may be inferred to be no more the contingent result of the accumulation of the sick in a close, humid, and hot air, than any one of the maladies just mentioned as analogous to it; and we know that there is no proof of any one of them having so originated, or having been caused by emanations from the sick of diseases different from itself.

143. *C. Can the crowding together of a number of persons in a close, hot, and humid atmosphere, and more especially in the close hold of a slave-ship within the tropics, so contaminate the air as to occasion, or rather generate, this distemper, and thus produce it, de novo, whenever the foregoing circumstances coexist in a marked degree?*—That the contamination of the air, especially when it is humid, warm, and close, either by other fevers or by other maladies, or by a number of persons previously in health confined in it, will take place, so as to produce fevers of a malignant character, more especially that fever which I have called Putro-Adynamic (*see* Fever, § 484–496), I have shown when treating of that malady (§ 496); but satisfactory proofs are wanting of this pestilence ever having originated in this way. Since my visit, however, to several places in Africa, and knowing the very limited space in which a large number of slaves are often confined, both on shore and in slave-vessels, I entertained the idea that this pestilence or its seminium, or specific infection, had been generated originally by the congregation of negroes in a close atmosphere, or is generated *de novo* by this race when placed in the circumstances now stated; and that, although it affects them in a comparatively slight manner, it is most particularly baneful to the natives of cold countries; as smallpox is comparatively mild in the white races, while it is most pestilential and fatal among the negroes. This opinion, entertained since 1817, I have endeavoured to ascertain the truth of whenever I have had an opportunity of making any inquiry respecting it; but the evidence is not sufficient to establish this as the source of the infection. The following, however, may favour the truth of this idea. A small vessel in which I was a passenger was anchored, in May of 1817, a short distance from Sierra Leone; and the ship's boat, with four of the crew, was bringing me on board, when a tornado suddenly overtaking us, we took shelter on board of a ship recently brought into the harbour full of slaves, and near which we were at the time. The men belonging to the boat took shelter down between decks. I remained under a small poop on the quarter-deck. All these men in two or three days were seized with this distemper, the vessel having just put to sea, and I escaped. The sick men were constantly kept on deck, free ventilation was enforced, and every possible precaution under the circumstances was used, and no more were attacked.

144. The organization of the negro, and the more extensive functions of the skin of this race as an excreting organ, give rise to a most offensive and foul state of the atmosphere, when numbers of this race are confined in a limited space, and particularly in a humid and warm atmosphere. Indeed, nothing can be imagined more nauseous and depressing than the respiration of air so contaminated; and it cannot be disputed that the concentrated and virulent effluvium generated from this source poisons the surrounding and sometimes stagnant atmosphere; and it may farther be admitted that it so affects the organic nervous system and the blood as to develop this pestilence, when all the circumstances requisite to the production of this effect exist in due force. The above fact, these considerations, and various occurrences or outbreaks of this distemper, after communications with slave-ships, that have come to my knowledge, induce me to attach some importance to this source of the evil, and to suggest that some endeavour should be made to ascertain the amount of credit it may deserve. At the same time, I must admit that some of the arguments I have used against the doctrines involved in the foregoing questions may be urged against this.

145. *D. Does this pestilence ever arise, de novo, from the decomposition of animal excretions or exuviæ, or of other animal substances, in a warm, humid, and still atmosphere; or from exhalations from foul or obstructed drains and sewers during states of the air favourable to their concentration?*—The remarks already made also apply, in some respects, to the present topic. If the distemper ever arises from negroes crowded in a confined space, as suggested above, this question should be answered in the affirmative, inasmuch as the accumulated cutaneous excretions in these cases are mainly concerned in causing it. That the putrefaction of animal substances

in a warm, humid, and stagnant atmosphere will cause malignant fever, cannot be doubted; the only question being, whether this pestilence, or a form of fever such as I have described under the name of *putro-adynamic* (Fever, § 484–496), will be the result. Circumstances have proved to me the production of this latter fever in these circumstances, and in forms more or less malignant and rapidly fatal; but I have no proof of the pestilence now being considered as having originated in this latter source. The same remark applies to the concentrated exhalations from foul drains and sewers. I believe that these are quite sufficient, especially before they are much diluted by the atmosphere, to occasion the putro-adynamic fever just referred to; but, after examining into the attempts which have been made to connect this pestilence with that cause, I believe them to have been quite futile, and by no means supported by even the slightest evidence. In many warm regions and climates, more especially in eastern countries, as shown in several parts of this work, emanations from the excretions, the exuviæ, and the dead bodies of animals, combine, with the exhalations from a humid or marshy soil, to give rise to a low or putro-adynamic fever, which may present, with more or less malignancy, evident remissions, more particularly when the terrestrial exhalations are the most influential in causing it, as shown in the article Fever (§ 435, 484), still this fever will not acquire an infectious character with a moderate attention to ventilation and the avoidance of crowding of the sick. When, however, emanations from the decomposition of animal matters, and from drains and sewers, are concentrated in a warm and humid air, and predominate over those from vegetable matter or from a marshy soil, the resulting fever will assume more or less of the continued type and putro-adynamic characters, and become infectious in circumstances favourable to the manifestation of this property. Still the fever hereby produced (and fully described in the article Fever, § 434, *et seq.*), is not the pestilence now under consideration; and I cannot find any evidence that this pestilence has ever really originated in this source.

146. In thus disputing the origination of the true pestilential yellow or hæmagastric fever in several sources to which it has been very loosely imputed, it may be stated that my skepticism is caused by the entire want of evidence of the truth of such occurrences, and by the very general assumption, without any proof, of these as the sources of the distemper. I have no favourite doctrine or cause of my own to support, and no theory to subvert, merely because it is different from the one in which I believe. I am most anxious to know the truth wherever the truth is obscured or difficult of access; but I lean the most to that doctrine which is most truthful, which rests on the most convincing evidence, and which, as being itself truth, is the safest to follow, and is, moreover, the most advantageous to adopt as regards the welfare of the general community.

147. *E. Is this pestilence, like to smallpox and scarlet fever, propagated only by a specific cause that may be preserved in fomites for a considerable time, without causing it, during circumstances unfavourable to its outbreak, but may occasion it as soon as those circumstances supervene which favour its operation, viz., a high temperature and a humid and still atmosphere?*—That the cause is specific cannot be doubted, inasmuch as the effect—the distemper—is also specific or determinate, as the other specific maladies just alluded to.* It has been repeatedly observed that this cause has been preserved in the bed and body clothes of those who have been affected by the disease for a considerable time, either when these clothes have been shut up from the air, or when they have remained during the cold months unexposed or unused; and that, when these fomites have been exposed among susceptible persons, and during states of the atmosphere favourable to infection, the disease has been reproduced. Thus, in several towns in the south of Spain, as shown by most of the authorities already quoted, the distemper has gradually ceased with the accession of cold weather; but it has appeared again in the summer, or as soon as the atmospheric temperature and humidity reached those grades which are requisite to the production of infection. If, therefore, it be admitted that the distemper is specific—is so determinate in character as neither to lapse into remittent fever, on the one hand, nor to pass into plague or putro-adynamic fever on the other; and that the cause is also specific, and, like other specific causes, capable of being preserved for a considerable period without losing its poisonous properties and capability of germinating and reproducing itself and the distemper, we may farther infer, whatever may have been its remote origin, that it is not a frequent contingent production or result of the circumstances to which it has been imputed, and which have just been passed in review. If it were a contingency merely of one or more of these circumstances, it must have occurred in other warm countries besides those in which it has been so frequently observed. It must, in this case, have appeared both in the eastern hemisphere and on the shores of the Pacific, where it has never been met with. It may, however, be stated that, while this consideration militates against the contingent production of the specific poison causing this pestilence in the circumstances against which I have argued above, it in some degree supports the opinion which I have suggested, as to the not improbable origin of the distemper in the concentrated emanations from the bodies of a great number of negroes confined in the close, humid, and hot holds of slaveships (§ 143). If this opinion as to the probable origin of the infectious poison be not admitted, there is certainly none other deserving greater confidence, and we are left entirely in the dark as to the earliest origination of the mischief, although the fact of the communicability and diffusion of that mischief cannot now be disputed, nor the circumstances which favour its communicability on the one hand, and those which prevent or retard it on the other. The cause being obviously specific, from the very determinate and specific character of its effects, we have no greater reason to believe, in the absence of conclusive proof of the fact,

[* The intermittent fever may be called a specific or determinate disease, and its cause is also specific. It is not necessary that the cause should be a specific animal virus in order to make the disease a specific one.]

that this specific cause is contingently produced in the course of other maladies, or in the circumstances above considered, than that the specific causes of smallpox, scarlet fever, and of other pestilences, are also contingently produced in similar circumstances.

[These facts do not certainly demonstrate the doctrine of the contagiousness of the disease, in the ordinary acceptation of the term; on the contrary, they are among those which led our countryman, Dr. RUSH, to abandon the belief in its contagious character, which he had held during the greater portion of his life. In his last writings on this subject (*Med. Inquiries*, vol. iv., p. 144) he remarks, "That the yellow fever is not contagious in its simple state, and that it spreads exclusively by means of exhalations from putrid matters diffused in the air, is evident from the following considerations: 1st. It does not spread by contagion in the West Indies. This has been proved in the most satisfactory manner by Drs. HILLARY, HUCK, HUNTER, HECTOR, M'LEAN, CLARK, JACKSON, BORLAND, PINCHARD, and SCOTT. Dr. CHISHOLM stands alone in maintaining a contrary opinion. 2. The yellow fever does not spread in the country when carried thither from the cities of the United States. 3. It does not spread in yellow fever hospitals when they are situated beyond the influence of the impure air in which it is generated. 4. It does not spread in cities from any specific matter emitted from the bodies of sick people. 5. It generally requires the co-operation of an exciting cause, with miasmata, to produce it. This is never the case with diseases which are universally acknowledged to be contagious. 6. It is not propagated by the artificial means which propagate contagious diseases, as inoculation, swallowing the matter of black vomit, &c. To the first four of these assertions there are some seeming exceptions in favour of the propagation of this fever by contagion. I shall briefly mention them, and endeavour to explain them upon other principles. The circumstances which seem to favour the communication of the yellow fever from one person to another by means of what have been supposed to be contagions, are as follows: 1. A patient being attended in a small, filthy, and close room. The excretions of the body, when thus accumulated, undergo an additional putrefactive process, and acquire the same properties as those putrid animal matters which are known to produce malignant fevers. I have heard of two or three instances in which a fever was produced by these means in the country, remote from the place where it originated, as well as from every external source of putrid exhalation." (In what respect does this differ from Dr. COPLAND's doctrine of contagion!) "2. A person sleeping in the streets, or upon a bed impregnated with the sweats or other excretions, or being exposed to the smell of the foul linen or other clothing of persons who had the yellow fever. The disease here, as in the former case, is communicated in the same way as from any other putrid animal matters." (Dr. RUSH gives several cases in illustration of this fact.) "3. The protraction of a yellow fever to such a period as to dispose it to assume the symptoms, and to generate the peculiar and highly volatilized exhalation from the pores of the skin which takes place in the jail fever." (This disease, Dr. RUSH maintained, was decidedly *contagious*, and he speaks of time, *i. e.*, protracted duration, 'rendering fevers of all kinds now and then contagious, by excretion,' &c. In ordinary cases he supposed the yellow fever was too transient to admit of the formation of this contagious excretion, but might become so in rare instances.) "4. Miasmata, whether from marshes or other external sources, acting upon a system previously impregnated with the excreted matters which produce the jail or ship fever. 5. A fifth instance in which contagion has been supposed to take place in yellow fever is, where the exhalation from the excretions of a patient in that disease acts as an exciting cause in persons previously impregnated with the marsh or other external miasmata which produce it. The activity of this exhalation, even when it is attended with no smell, is so great as to induce sickness, headache, vertigo, and fainting." (Cases in point are given.) "In the months of July and August," says Dr. R., "when miasmata are generally local, and float chiefly near to their hot-beds, the docks and holds of ships, persons who are affected by these miasmata, and sicken in other parts of the city, never communicate the disease; but after the less prepared and heterogeneous filth of our whole city has been acted upon by an autumnal as well as summer sun, so as to emit pestilential exhalations in all our streets and alleys, the fever is now and then excited in the manner that has been mentioned by a single person in a whole family. The common intermittents of the Southern States are often excited in the same way, without being suspected of spreading by contagion. Even the jail or hospital fever is vindicated by Dr. HUNTER from the highly contagious nature which has been ascribed to it upon the same principle. He remarks, in relation to this fever (typhus), 'In considering the extent and power of the contagion, I am not inclined to believe that this causes the fevers of all those who are taken ill in one family after the first, as they are all along exposed to the same vitiated air which occasions the first fever. In like manner, when a poor woman visits some of her sick neighbours, and is taken ill herself, and afterward some of her children, I would not impute the disease to infection alone, she and her family having previously lived in the same kind of vitiated air which originally produced the fever. If the cases in which the infection meets with the poison already half formed be excepted, the disease in itself will be found to be much less infectious than has commonly been supposed.' By the modes of communicating the yellow fever which have been admitted, the dysentery, and all the milder forms of autumnal fevers, have been occasionally propagated, and, perhaps, oftener than the first-named disease, from their being more apt to run on to the typhus or chronic state. 6. The last instance of supposed contagiousness of the yellow fever is said to arise from the effluvia of a putrid body that has died of that disease. The effluvia in this case act either as the putrified excretions just mentioned under the first head, or as an exciting cause upon miasmata previously received into the system. A dead body, in a state of putrefaction from any other disease,

would produce, under the same circumstances of season and predisposition, the same kind and degrees of fever. The similarity of the fever induced by the means that have been enumerated, with the fever from which it was derived, has been supposed to favour the opinion of its being communicated by a specific contagion. But let it be recollected that the yellow fever is, at the time of its being supposed to be thus received, the reigning epidemic, and that irritants of all kinds necessarily produce that disease. The morbid sweats which now and then produce an intermitting fever, and the alvine excretions which occasionally produce a dysentery, act only by exciting morbid actions in the system, which conform in their symptoms to an immutable and universal law of epidemics." Dr. Rush then assigns his reasons for believing that yellow fever is propagated by means of an impure atmosphere, at all times and in all places, which are chiefly the following: "1. It appears only in those climates and seasons of the year in which heat, acting upon moist animal and vegetable matters, fills the air with their putrid exhalations. 2. It is unknown in places where a connexion is not perceptible between it and marshes, mill-ponds, docks, gutters, sinks, unventilated ships, and other sources of noxious air. 3. It is destroyed by means of long-continued and heavy rains; also by frost, intense heat, and high winds." Dr. R. then proceeds to point out the advantages which are to result from a belief in the non-contagiousness of yellow fever (*Med. Inq.*, vol. ii., p. 166), to which we beg to refer the reader.

We have thus, in accordance with a sense of duty toward our distinguished countryman, whose writings on this subject have been strangely neglected by our author, given a synopsis of his leading views in relation to the nature and mode of propagation of this fatal malady. The reader will perceive that, notwithstanding the apparent difference of opinion between him and Dr. Copland, there is not, after all, that discrepancy which can justify the severity of language indulged in towards those who seem to hold different views on this important subject, and that, if their terms were duly defined, and exceptions and explanations regarded, there would really, after all, be little cause for disputation.

Prof. J. B. Beck, of New-York, has written as ably against the contagiousness of yellow fever as any other American author. (See *New-York Med. and Phys. Jour.*) We present but a single quotation. "There are some persons," says Dr. B., "who have contended that yellow fever may be contagious in one kind of air, and not so in another. All the testimony adduced from the fever of 1822 is directly adverse to this position. If we suppose the cause of yellow fever to enter into chemical combination with the surrounding foul atmosphere, then it would no longer be the same disease. If, on the other hand, the air serves merely as a medium for transmitting the poison to a greater distance, then no reason can be assigned why, if you approach near enough to the sick body, contagion should not display itself as well in a pure as in an impure atmosphere. It has been already shown that not merely in the pure air of the country, but even in the most impure and unhealthy parts of our city, patients sick of the yellow fever in 1822 were uniformly approached with perfect impunity. The air, therefore, in the infected district must have been more venomous than the contagious poison itself coming off directly from diseased bodies; that is, poison diluted in atmospheric air must have been more powerful than pure, unmixed poison itself—a proposition absurd in itself. We infer, then, as the air of the infected district was more deleterious than actual contact with the sick, the poison existing in the air must have been some other than effluvia from the bodies of the sick" (*loc. cit.*).

We deem it unnecessary to enter at length upon the discussion of the contagiousness or non-contagiousness of this disease. Dr. Copland has exhausted the arguments in favor of the former doctrine, and it would require equal space to set forth those connected with the latter. 1. We hold it to be a specific disease, and not a high or malignant grade of bilious remittent, as held by Rush and others. 2. It is propagated by an infected atmosphere; but in what this infection consists is entirely unknown. 3. It is not communicated from one individual to another in a pure air, in which respect it differs from all other admitted contagious diseases. 4. It does not owe its origin to those miasms which cause remittent and intermittent fevers. 5. The cause, whatever it may be, is often aided by a kind of epidemic influence, the nature of which is unknown, but which gives efficiency to the specific cause, although it does not originate the disease when that cause does not exist. 6. There are certain conditions and circumstances which act as predispositions to the disease, and there are others which act as exciting causes; but in all cases the individual must be exposed to the peculiar specific cause.]

148. VIII. Nature of this Distemper.—It has been supposed that the plague of Athens, described by Thucydides and noticed by Plutarch, was identical with this malady; and certainly the resemblance between them is strong in many points. Thucydides states that it prevailed in Lemnus and other places, although not so extensively and fatally as in Athens, where it afterward appeared; that it suddenly broke out in the port, the Piræus, and extended over the city; that when it had reached the upper parts of the city it had become most fatal; and that, having ravaged Athens, it was conveyed to other places which were most populous. These are the specific statements of Thucydides, and indicate a similar importation of an infectious malady and its extension from the port over the city, and to places with which the intercourse was greatest, to that demonstrated on several occasions in the south of Spain during the last fifty years. The infectious nature of the Athenian plague is still more distinctly stated by Plutarch, who remarks that the distemper appeared in the army with which Pericles besieged the sacred city of Epidaurus, and affected not only it, but all those also who had intercourse with it. (Plutarch, *Vita*, &c. 8vo, Lond., 1729, vol. i., p. 378)

149. Not only in their propagation, but also in their symptoms, may the resemblance between the Athenian and the hæmagastric pestilences be traced. Thucydides notices the

peculiar febrile heat, and the pale greenish yellow (χλωρὸν) and livid colour of the surface of the body; the singular affection of the parts of generation; the excessive sense of internal heat; and the peculiar amentia, insanity, or apathy attending the distemper. The abundant bilious evacuations mentioned by him may have been the black or dark-brown matters characterizing the modern distemper, for it cannot be doubted that the black stools produced by altered blood were ascribed to black bile by the ancients. He farther notices the very rare occurrence of relapses; the fact of the disease never having seized the same person a second time; and the greater liability of strangers, and of persons from the country visiting the city, to be attacked.

150. Whatever may have been the original source of this distemper, in whatever way the cause of it may have been at first generated, and however this cause may have been afterward preserved and propagated, there can be no doubt of the appearance of it in many places and on many occasions, where it can be accounted for in no other mode than by referring it to the operation of an infectious emanation proceeding from a recently affected person, or from clothes imbued with this emanation. The difficulty of obtaining information as to the first persons attacked is always great, and sometimes impossible, as respects not only this distemper, but all other infectious diseases; and hence the early proofs of infection can rarely be obtained even as regards any of them. In respect of the outbreak of this pestilence in America, Africa, and Europe, we know that it has occurred both after and during states of season and weather of the most different and even opposite kinds; the only atmospheric requisites to its appearance being high ranges of temperature and of humidity. It has occurred in the driest and in the most marshy situations; in dry as well as in rainy seasons; after prolonged droughts, and after excessive rains; on the surface of all soils, whether rocky, sandy, gravelly, or clayey; and in ports, towns, garrisons, forts, and ships of all descriptions, both foul, clean, unhealthy, and healthy, and placed in every possible circumstance that may be conceived in respect of them. It has appeared in one or two isolated persons who had not previously breathed the foul air of sick wards or apartments; nor visited the places in which either the sick or the healthy had been confined; nor inhaled the effluvium from decomposing exuviæ and animal substances; and thus, by the exclusive process of reasoning, we have left only that cause to which I have imputed it; and by means of which it is as undoubtedly propagated and perpetuated as any other malady whose infectious properties are admitted.

151. The terrestrial exhalations believed by Dr. Fergusson and others to be emitted from the fissures of the soil, caused by prolonged drought, or from the dried-up beds of rivulets, &c.; the wooden theory propounded by Dr. Wilson, and its combination with a limestone influence; the malaria carried by winds from great distances, or issuing forth in currents of only a few feet in diameter; the emanations from bilge-water and ballast; and the vegetative principle imagined to be thrown out from rich absorbent and alluvial soils, are the several sources which have been assigned; but are merely illusions which have played before the minds of medical theorists, and which are dissipated by a more comprehensive glance of the very different circumstances attending each outbreak of the pestilence. The chief circumstances which remain without very material alteration, in all the most destructive visitations of the distemper, are certain ranges of heat and humidity, a still atmosphere, or an imperfect renewal of the air, and a more or less dense population; all which especially favour the propagation of infection of every kind, and which are indispensable to the extensive prevalence of this distemper.

152. *The pathological inferences* which may be drawn from what has been advanced respecting the *causes*, the *symptoms*, and *course*, and the *consequences* of the distemper, may be stated as follows: 1st. Of the numerous *causes* and *sources* which have been assigned to this pestilence, there is not one which has been ascertained to have existed in all, or even in the majority of, the occurrences of it since it became in modern times the subject of medical interest, with the exception of a *specific infection*, or poisonous animal emanation proceeding from the sick, and directly, or by fomites, affecting those among the healthy who have not previously been attacked, and who are otherwise predisposed. It should not be overlooked that the majority of those who have reasoned against the operation of this cause have either wittingly or ignorantly overlooked the now well-established fact of the immunity from a second attack, produced by the first, and have attributed much importance to the escape of many of those among whom an infected person has been placed, without admitting the great probability of the majority of those having been protected by their having had the disease. This particularly applies to the intertropical parts of America, and to many of those who have written upon the disease as it has there appeared, and who have even never inquired into the manner in which this exemption affects the diffusion and prevalence of the distemper, nor in any way concerned themselves with this very important fact, although it so very materially affects the results, and although they present themselves before the profession with the dogmatism of an infallible inspiration.

153. Secondly, that the effluvium proceeding from the bodies of the affected being so remarkably offensive as to attract the notice of every observer, is itself a proof of the infectious nature of this distemper; for when it is admitted even in single and isolated cases, how much more remarkable must this fetor become when numbers are affected in a humid, warm, and still atmosphere, and in a limited space, in which circumstances even the birds in the air and the lower animals are also infected. Dr. Imray, who has given a remarkably correct description of this pestilence as it appeared in the island of Dominica in 1838, where it could not be expected to have been very prevalent among old residents, owing to the exemption arising from a previous attack, and where, indeed, he states the number attacked to have been small, with the exception of the military, remarks that the "odour of the cutaneous exhalations was often extremely disagreeable, as well to the patient

himself as to his attendants," and that "*the fetor became more intolerable towards the last stage of the distemper.*" Now I believe that every one whose experience of diseases attended by much fetor of the exhalations from the skin and lungs [is extensive], will admit that these diseases are more or less contagious or infectious, especially in the circumstances so frequently alluded to above, and where numbers are exposed to this cause, or inhale an atmosphere contaminated by these exhalations. There can be no doubt, however, that, where those exhalations are much diluted by the atmosphere in an open situation, they will generally fail in producing those effects which undoubtedly result from them in a close, crowded, and humid air, and where numbers of predisposed persons are congregated. The dissipation of these exhalations by a rapid renewal of the air is the chief cause of the limited extension of the distemper to high and open situations, and to places thinly inhabited, and is one of the chief means of arresting the progress of an epidemic, facts proving what reason asserts, namely, that on those occasions of the outbreak of the distemper in close streets and barracks, the removal of the inhabitants to open and airy grounds and encampments, so that a free perflation is allowed under the tent-cloths, is always followed by a rapid subsidence and total disappearance of the malady. A person from the country visits a town in which the malady is prevalent, and another from a ship lands in the same town, and both persons probably visit the same place or house in which the disease exists. Both persons, if unprotected by any circumstances, and equally predisposed, are infected, but the infection will not become manifest until two or three days subsequently. The one returns into the country and is attacked, but, owing to the circumstances favouring the communication of the malady being wanting there—owing to free ventilation, a high and airy situation, and a sparse population, with numerous other favourable circumstances—the distemper either extends no farther, or extends merely to a few, even in the absence of any other sanatory measures; while the sailor returns to his ship, and in the ill-ventilated, and perhaps over-crowded forecastle, or between decks, where he is confined, he communicates the malady to every one who is not protected by a previous attack. Now these occurrences have actually taken place, as now stated, times out of number; and, moreover, the additional fact has been often observed of a third person having come from a distant town and city, been infected at the same place as the two others, and carried the infection to such town where he has sickened, and, owing to crowding, ill-ventilation, and other circumstances favouring infection, the malady spreads rapidly, although it has proceeded no farther as respects the first person here instanced.

154. Thirdly, if we connect the circumstances attending the impression made by the exciting cause of the distemper—by the effluvium from the affected—if we consider the phenomena which immediately result, those which are subsequently developed, and the lesions which are ultimately produced, we shall have every reason to conclude that this cause produces a specific morbid impression upon the organic nervous system through the medium of the lungs; that it changes the vital manifestations of this system, and contaminates the blood; and that this contamination farther affects the organic and cerebro-spinal nervous systems, which again, in their turn, react upon the vascular system and blood, until the vital tone and cohesion of the tissues and capillaries are remarkably impaired, and the vital crasis of the blood more or less dissipated.

155. Fourthly, it cannot be doubted, by any person who has seen both maladies, and who is uninfluenced by partisan views, that this pestilence is altogether distinct in its causes, its progress and course, and in the lesions found on dissection, from more malignant states of remittent fever. The admission is made by many of the non-infectionists themselves; and sufficient has been adduced above (§ 37, 122) to prove this difference. In those cases of the pestilence which proceed more rapidly to the extinction of life, the poisonous emanation which has infected the body produces but little structural lesion in its fatal course, excepting the changes in the digestive mucous surface and in the vascular system, especially in the blood. The viscera present no remarkable alteration beyond the defect of vital cohesion just mentioned, and the tendency to rapid decomposition. The pale yellow appearance of the liver, first accurately observed by the French physicians, who described the distemper as it appeared in Spain, and subsequently noticed in the West Indies by Dr. Imray and others, is obviously occasioned by the loss of blood from the digestive mucous surface. The loss of the vital cohesion of this surface and of the capillaries supplying it, and the more or less extensive detachment of the epithelium, with the other changes described above (§ 26, *et seq.*), are consequences of the remarkable depression of the organic nervous or vital energy, and of the changes produced in the blood by the poisonous emanation causing the infection.

156. Fifthly, that the changes produced on the blood are not merely the ultimate effects of the disease, but supervene, to a certain extent, at a more or less early stage, in consequence either of the morbid impression made on the organic nervous system by the exciting cause, or of the absorption of the cause into the blood itself during the respiratory process, or of a combination of the two modes of operation, is sufficiently evident from the appearances of the blood during the earlier periods of the malady. In the cases where the vital depression and changes in the blood are the greatest at these periods, blood-letting would be improperly, and has been rarely, resorted to; but in those cases where vascular tone and action have been less impaired, and where the blood has consequently presented the least amount of change observed in this distemper, this fluid, even at the time of its escape from the vein, has been more or less altered. It has generally been much darker than natural, and it has separated very imperfectly into serum and crassamentum. This change in the blood, remarked and described by me many years ago, is farther noticed by Dr. Imray in the epidemic observed by him in the West Indies. He states that "the blood, as it flowed from the arm, presented a singularly mixed appearance, as if the

vein had contained two differently coloured fluids, the one bright red, the other almost black; and on examining the blood an hour or two after being withdrawn, the separation into serum and crassamentum had taken place very imperfectly. In the centre was observed a loose coagulum, easily broken down, the surface of which was streaked green and yellow, the serum being in large quantity, and intimately mixed with the colouring matter of the blood. These changes in the vital fluid were invariably noticed to a greater or less extent in every instance where blood-letting was had recourse to, which was always at the very outset of the attack; and as the disease advanced to the last stage, the blood was so altered and broken down as to escape from the capillary vessels of all the mucous surfaces." (P. 92.)

157. Sixthly, the changes in the digestive mucous surface more especially, and in the crasis and constitution of the blood, favour the escape of this fluid from this surface, and these are necessarily followed, near the close of the attack, and when the black vomit and anal evacuations are very abundant, by an anæmial state of the liver, giving rise to the pale yellow hue of it so generally observed after death. At an advanced stage of the malady, more especially, and even from a very early period, the organic nervous or vital power, by which the portal circulation is chiefly carried on, is more or less impaired; and, consequently, the abdominal organs and digestive mucous surface become congested. As vital power and the crasis of the blood are farther impaired with the progress of the disease, the congestion increases, and ultimately the digestive mucous surface allows the altered blood to exude from the weakened and overloaded capillaries; and the discharge from these capillaries into the digestive canal proceeds with an increased rapidity as the portal circulation becomes more and more impaired. The loss of blood from this surface at last leaves the vessels of the liver comparatively empty, and the organ pale, notwithstanding the dark appearance of the blood at this period. The changes which are thus early and extensively produced in the vascular system and gastric organs, and the prominence of the symptoms referrible to them during the progress of the distemper, have suggested the name *hæmagastric*, which I have used to designate the distemper, and to distinguish it from those states of remittent fever which are often attended by yellowishness of the skin.

158. Seventhly, although the digestive organs and vascular system betray the most prominent affection during the progress of the distemper, still the nervous system, and more particularly the organic nervous system, with the organs chiefly supplied by it, are very remarkably, and most probably primarily affected. The morbid impression made upon this system, and the contamination of the blood, whether they be produced in succession or contemporaneously, ultimately, at least, react on each other, until the functions of vital and of excreting organs, and the vital cohesion of the several tissues, are impaired to an extent incompatible with the continuance of life. The consequences necessarily flowing from the morbid impression made by the cause of distemper upon the nervous systems are impairment of the functions of the lungs—the channel through which this impression is made—diminished secreting and assimilating actions of the liver; and, consecutively, an almost total suspension of the functions of this organ and of the kidneys. A marked diminution, also, of the cutaneous and intestinal exhalations and secretions is present from an early period of the attack. The results of these changes, as respects the blood, are the accumulation of effete and injurious elements in this fluid, and the combination of them, as they are partially eliminated from secreting surfaces, into those specific infectious emanations which propagate the pestilence. When the alterations in the nervous and vascular systems, in the blood, and in the several tissues are approaching an acme, the altered blood exudes from the relaxed capillaries and tissues, especially from the digestive mucous surface; and when the passive hæmorrhages which thus supervene are considerable, previous congestions are removed, and the portal vessels and larger veins are either left comparatively empty, or contain a small quantity of black fluid or semi-dissolved blood. With the failure of organic nervous power, the due adaptation of vascular tone to the states of vascular fulness on the one hand, or of vascular deficiency on the other, is lost, and the progress to a fatal issue is greatly accelerated, without the conservative influence of life being able to arrest the advance. But when the passive hæmorrhages in the last stage are considerable, the fatal result is rapidly accelerated, owing to the powers of life being inadequate to the adaptation of vascular tone and action to the amount of circulating fluid, and to the quality of this fluid being such as further depresses the already depressed state of the nervous systems.

159. Eighthly, whether the progressive alterations in the blood actually arise as stated above (§ 154), or are owing to the introduction into the circulation of the infectious molecules given off from the affected, and inspired with the air in which these molecules float, is a question which does not admit of a positive answer in the present state of our knowledge. If we adopt the latter alternative, it follows that the absorbed molecules, which infect the system, multiply themselves either in the blood or during the processes of excretion; and that the morbific leaven thus introduced gives rise to the progressive phenomena of the disease in the process of reproducing their kind, and in the course of vital deterioration and vascular contamination.

160. The inferences which I have now attempted to draw from what appears established as to the *causes* and *nature* of this pestilence must, at least in the present state of our knowledge, be made the basis of those measures which should be adopted, 1*st. For the protection of the general community*; 2*d. For the prevention of individual attacks in circumstances of imperfect general protection*; *and*, 3*d. For the recovery of the affected.* As the measures for the attainment of the first and second of these objects are nearly the same as regards the three kinds of pestilence discussed in this article, I shall consider this important topic in a separate chapter, and with reference to each of

these pestilences. (*See* PESTILENCES, GENERAL AND INDIVIDUAL PROTECTION FROM.)

161. IX. TREATMENT.—There are very few distempers which are less under the control of treatment than that now under consideration, or in which the protective influence of life is less manifestly exerted. Persons who are the most robust, the previously healthy, the young, and those in the vigour of life, are generally the most susceptible of infection, the most violently attacked, and often the most rapidly carried off. Something, however, may be attributed to the dose of the infectious emanation, or poison, which has impressed and contaminated the frame; and something, also, may be owing to the violence of reaction in persons of a plethoric habit of body and strong constitution. In the first case, the concentration and intensity of the cause may be so great as to overwhelm even the most powerful, and to annihilate altogether that vital resistance which is always opposed, in various grades in different persons, to the influence of injurious agents; in the latter case, excessive action, while vital power is depressed, rapidly exhausts itself, and accelerates, with remarkable rapidity, those changes in the blood which so generally supervene upon high vascular action in warm climates or in hot seasons, and more especially in robust and plethoric persons who have recently migrated from a cold to a warm country. From this it is manifest that the treatment which is advantageous to persons circumstanced as these latter are, cannot be equally, or even at all, beneficial to others who are otherwise circumstanced, or to those who have resided long in a warm, or in an unhealthy climate; and it is equally obvious that medical means will be of service, or even detrimental to the person requiring them, according to the judgment regulating the exhibition of them appropriately to the morbid conditions existing in each case individually, and in the same case at the several stages of its course.

162. The treatment, also, should be modified, or even very different, according to the circumstances in which the patient is placed during its employment, for the patient who is removed into an open, well-aired, and healthy locality before he is attacked, will bear, and indeed require, very different measures from those required by persons who remain in the close, low, and infectious air of a crowded hospital, or in the sick bay of a ship-of-war. Hence the necessity of removing those who are attacked as much as possible from under the influence of the contaminated air in situations where numbers are affected, and of preventing the air surrounding them from being contaminated by as rapid a renewal of it as possible. Thus, in cases of infection in low and ill-ventilated houses and streets, removal to a well-ventilated hospital, or even tents having a continued current of air passing under the tent cloths, is most beneficial, not merely as respects the chances of recovery, but also in arresting the progress of infection, for the contamination of the air surrounding the patient is thereby prevented, at least to that degree which is hurtful to himself and infectious to others. In the instance observed by myself, of several sailors becoming infected by communicating with a slave-ship, the sick were constantly kept on deck, sheltered only from the sun by means of an awning, open all around, and the result was most favourable as regarded the infected, the distemper not extending farther than to those men who had gone on board the slave-ship.

163. Impressed with the necessity of applying the means of cure with strict reference to the peculiarities of individual cases, and of each stage of these cases, I shall not attempt to describe the treatment which is more especially applicable to the disease as it occurs in different *constitutions* and *temperaments*, because I should thereby be led into irksome repetitions, and very imperfectly accomplish the end in view. Besides, different constitutions and temperaments are not so readily recognised, nor are they so precisely marked out, as to enable practitioners of even admitted discernment to detect them during the tumultuous disorders of function characterizing this distemper. The means which are particularly suitable to *grades of intensity*, and to *the several stages of the disease*, may be stated with more reasonable hopes of advantage to the inexperienced; still it should not be overlooked that the malady is very mutable in its character, and that an attack which may appear very slight, and by no means dangerous, during the second, third, or even the fourth day, may suddenly change its state, and become remarkably severe, or even rapidly fatal. Having particularized the several grades (§ 6, *et seq.*) and stages (§ 21, *et seq.*) of this distemper, I shall first give a rapid sketch of the treatment which appears to me the most appropriate to each *grade* and *stage*, and afterward notice those means individually which have been or may be employed, and endeavour to estimate the true value of each.

164. *i.* TREATMENT AS TO GRADE OR FORM.—*A.* IN THE MILDEST FORM (§ 6), our chief reliance should be placed on free ventilation, and due promotion of the several secretions and excretions; measures equally applicable to all forms of the distemper. The bowels ought to be early evacuated by means of calomel with jalap or rhubarb, or any other purgative, and afterward kept open by olive-oil taken by the mouth, and administered freely in enemata. A tepid bath or the cold affusion may be resorted to, if there be much heat of skin; and, after the surface has been carefully dried, frictions of the trunk and all the limbs with olive-oil will prove extremely beneficial, and favour a free perspiration. This object will be farther promoted, after the bowels have been freely evacuated, by the exhibition of the liquor ammoniæ acetatis and the spiritus ætheris nitrici, in bland diluents or demulcents. In the majority of cases of this grade, nothing more than the above may be required; light farinaceous articles of food and simple emollient diluents being allowed as the febrile action subsides. If, however, the abdominal excretions are not duly evacuated by these means, they should be repeated in increased doses; the oil should be more freely administered, and the oleum terebinthinæ, or common salt, may be added to the enemata, which may be repeated according to circumstances. If the malady should suddenly assume a severer form, the treatment hereafter to be described may

be resorted to. The physician should endeavour throughout to inspire confidence in the mind of the patient, and to dissipate despondings ideas.

165. *B.* The Treatment of the more Severe Form (§ 7) of this pestilence is generally beset with more or less difficulty. In many instances a recourse to the foregoing means may be the most judicious, at least until the more serious symptoms characterizing this form supervene; and they are the more likely to be of service if the bowels are freely acted upon by them, and if the perspiration is copious and general. In these circumstances, a recourse to the more heroic and perturbating means may be productive of more mischief than benefit. Where vascular action appears high, blood-letting has been advised by many, and many have been induced to employ it, and to repeat it even oftener than once; the seductive calm produced by it for a few hours often alluring the reckless and the inexperienced to carry it to an injurious amount. But the calm is only momentary, and is generally followed by reaction still more violent than that preceding it, although vital power and resistance are materially depressed. Unless in the circumstances hereafter to be noticed (§ 167), and regulated as will be mentioned, this measure is of doubtful efficacy, and in most instances should not be resorted to.

166. If the means now mentioned he followed by a subsidence of the disease, attention to the several secretions and excretions, and to diet and regimen, will insure recovery; but if the morbid actions assume an onward course—if the pulse become weak, compressible, unequal, irregular, or slow; and more especially if discoloration of the skin about the neck, chest, &c., appear, either alone or with increased irritability of stomach, a most dangerous exhaustion of vital power has now taken place, and powerful stimulants, or other restoratives, as about to be advised for the *third stage* of the malady, are urgently required. To these symptoms black vomit and hiccough are soon added, if they be not removed by energetic means; and in many instances such means will fail in producing the desired effect. Nevertheless, they should be employed perseveringly, and be variously associated, according to the changing features of the case. Sulphate of quinine, with camphor and capsicum, or with the addition of opium, each dose being immediately followed by a glass of Champagne; friction of the general surface with olive-oil and spirits of turpentine, or embrocations of these kept constantly applied over the epigastrium and abdomen, by means of flannel frequently imbued with them; enemata with olive-oil, turpentine, and asafœtida; and even more powerful stimulants than the above, as brandy with an equal proportion of water, ammonia, or others hereafter to be mentioned, are the chief means on which any reliance can now be placed. If black vomit be imminent, or commence, an occasional dose of spirits of turpentine with olive-oil, and two or three grains of capsicum; sulphate of quinine, with sulphate of zinc and opium; or the acetate of lead, with camphor and opium; the acetate of lead, with creasote, acetic acid, and tincture of opium, brandy in small quantity, but given frequently with arrow-root, sago, &c., and the enemata already advised, may, even in this almost hopeless state, be followed by recovery in some instances. In all cases a careful watching for the successive changes taking place in the advanced course of the malady, and a recourse to means which are appropriate to them, with good nursing, are among the most essential requisites.

167. *C.* The Treatment of the Third Form (§ 9) is not very different from that just considered. Blood-letting, if at all resorted to, should be employed only at the commencement of vascular reaction, and be confined to the young, plethoric, and robust. It ought not to be carried so far as to produce at any time full syncope, for excessive reaction is the more likely to return when this effect is produced by it. Even in this form, and in this class of patients, it is doubtful whether or no general blood-letting is of service. I believe that it will rarely prove beneficial in those cases which remain during the treatment within the range of the contaminated atmosphere surrounding numbers of persons affected by the pestilence, or in low, humid, and ill-ventilated places. An early recourse to the tepid hath, followed by frictions of the surface with olive-oil; to purgatives and cathartics with calomel, in full doses, and promoted by enemata containing olive-oil and turpentine; and to the diaphoretics already mentioned (§ 164), ought not to be neglected. When the vascular excitement is about to lapse into exhaustion, the means already advised, as well as those about to be noticed (§ 173), are the most deserving of confidence.

168. *D.* In the Fourth Form (§ 11) of this malady, blood-letting in any mode is most injurious; and the means required for the third stage (§ 172) are early required. The early exhibition of chologogue purgatives in full doses, and the promotion of their action by means of the enemata already mentioned, and by olive oil taken internally, in frequent doses; the warm hath, followed by assiduous frictions of the surface with olive-oil and turpentine; and an occasional dose of spirits of turpentine (from one to four drachms) with one or two drops of creasote, and two or three grains of capsicum, taken on the surface of milk, coffee, or any aromatic water, aided by the more powerful stimulants noticed above (§ 166), as the symptoms may indicate the necessity of having recourse to them, are the means most likely to make that impression upon the system which is required to subvert the morbid action, to support the conservative influence of life, and to restore the secreting and excreting functions. When yellowness of the skin, black vomit, or passive hæmorrhage supervene, the measures already mentioned, and others to be noticed in the sequel, may be adopted, although with faint hopes of deriving advantage from them.

169. ii. Treatment of the Stages.—It is unnecessary to remark at any length upon the means which the pathological states characterizing these stages may suggest.—*A.* The First Period, *or that of invasion* (§ 21), is generally so sudden in its accession, and passes off so rapidly, as often to elude the observation of the physician. In some cases, also, it is extremely slight, or the chills, rigours, or horrors characterizing it are either so little complained

of by the patient, or so imperfectly manifested, or even so entirely wanting, the disease approaching most insidiously with most of the symptoms of the second stage in a slight degree, as almost to warrant a total disregard of it in many instances. When it is present, measures should be taken to counteract the injurious impression produced on the frame by its continuance, to restore the equilibrium of the circulation, and to procure freedom of secretion and excretion. The immediate removal of the patient into an uncontaminated atmosphere; a warm bath with frictions of the surface both in the bath, and when removed from it; or warm baths medicated with aromatic and stimulating substances, and followed by frictions of the surface with olive oil; warm and chologogue purgatives; and warm diaphoretics and diluents, are the most appropriate to this period. But we cannot expect these to cut short the disease, or prevent the accession of the other stages. All that we can hope for, seeing that this stage indicates the actual infection of the frame, is to render the periods succeeding it more mild, and more amenable to treatment, than they might prove if it had been left to the unaided efforts of nature; and possibly to prevent that contamination of the circulation which takes place, and advances with the progress of the distemper.

170. *B.* In the Second Stage (§ 22) the treatment should always be conducted with a perfect conviction of the important truth that, however high arterial action or nervous excitement may appear, and however robust and plethoric the patient may be, both the action and the excitement are unattended by vital power or organic nervous energy or tone. Vitality is overpowered or poisoned by the infection contaminating not merely the nervous and vascular systems, but the whole frame. Hence the very general failure of blood-letting even in those cases which seemed most urgently to require it. For, owing to the relaxation of the tissues, the want of tone throughout the vascular system, and the early contamination of the blood, the vessels soon lose the power of accommodating themselves to any marked diminution of the usual amount of their contents. With this pathological state, the use of tonics and restoratives is by no means incompatible; and, as I have proved on numerous occasions, the only way of subduing excessive action, when thus associated with deficient and sinking power, is to administer the more permanent stimulants, or such tonics as are most efficacious in counteracting the loss of vital cohesion of the soft solids and of the crasis of the blood, a loss more or less rapidly advancing during the unfavourable progress of the distemper. Instead, therefore, of endeavouring, as many have advised, to overcome the vascular excitement characterizing this stage by means of blood-letting and depressing agents, I would recommend the exhibition of camphor, sulphate of quinine, ammonia, capsicum, decoction of cinchona, chlorate of potash, spirits of turpentine, wine, brandy, &c., either singly or in such combinations as the states of the case may require. During this stage the blood is not only deficient in fibrin, but also in those healthy requisites resulting from complete assimilation and free excretion of effete elements; and the deficiency of fibrin, of healthy crasis, as well as of normal purity, increases progressively through this and the succeeding stage, until these several morbid conditions reach their acme. Now, by what means are these changes most surely counteracted or arrested in their course? If not by the above means, we shall have much difficulty in finding others more efficacious than they. It will be in vain to attempt the cure of the malady, even in this comparatively early stage, by any other means than such as are capable of producing these effects—of counteracting or arresting these changes. Can blood-letting possibly accomplish these ends? It may possibly indirectly aid other measures to this effect; but this is the utmost amount of its agency as respects the blood; and it may save, in a few instances, some important organ from injury during the height of reaction. With this latter view it is most frequently practiced; but I much doubt its capability of producing this effect in this distemper, and am inclined to believe that this solitary advantage is more than counterbalanced by several unfavourable contingencies; for the increased loss of power, consequent upon blood-letting during morbid states of the blood, is as frequently followed by hæmorrhagic or serous effusions or exudations as the pre-existent state of vascular fullness; for, after blood-letting, the accommodation of vascular tone to the amount of the vascular contents is deranged, and various consecutive changes take place that might not otherwise have occurred. In some of the less violent states of vascular excitement, when the pulse is less rapid, and less expansive or tumultuous, where it is less open, and presents more of tone than is observed in the more violent and rapid states of vascular excitement, the liquor ammoniæ acetatis, with potassæ nitras, and spiritus ætheris nitrici, taken either in camphor mixture, or in the decoction or infusion of cinchona, will often prove of manifest service, especially after the bowels have been freely evacuated, and the functions of the skin restored by the tepid bath, and frictions with olive oil.

171. In this period the urgent thirst usually present should be alleviated by spruce beer, soda water, or by water rendered pleasantly acid with vinegar, raspberry vinegar, lime-juice, &c. Of these I prefer either of the kinds of spruce; but the selection should partly be guided by the nature of the medicines prescribed, and the quantity taken at each time should be small, as large draughts, especially of cold fluids, are very soon afterward followed by vomiting. Even at this stage of the more severe cases, and especially of the 3d and 4th forms (§ 9–11) of the malady, restorative and stimulating beverages, taken often, but in a moderate quantity at a time, are frequently of service, and are the only drinks which should be allowed. Of these, Champagne or bock, with soda water or Seltzer water, or with milk; small quantities of brandy in spruce beer; and, in other circumstances, Seltzer water with milk, or milk with lime water, are to be preferred. In general, it is preferable to allow a considerable portion of the fixed air to escape before the fluids containing them are taken, as this air distends the stomach, occasioning a reaction of its coats, followed by the rejection of the distend-

ing body, in the form either of painful eructations or of vomiting.

172. *C.* THE TREATMENT OF THE THIRD STAGE (§ 23) has been partly anticipated (§ 168, 171). In the favourable cases of the distemper, the vascular excitement glides into a calm, attended by a return of the secretions, and by a general and genial warm perspiration; and the third stage, or that of vital depression or exhaustion, can hardly be said to have appeared. But, unfortunately, in the more violent attacks, and when the vascular excitement of the second stage has been excessive or violent, vital power is so depressed or overwhelmed as to be unable to make the usual resistance, or it sinks in the struggle. When such sinking or exhaustion appears, whether suddenly or more gradually, the energies of life require to be supported by means which may be rationally inferred to be commensurate with the existing depression. It will be seen, from what I have stated above (§ 170, 171), that I would advise the depression characterizing this stage to be anticipated by a somewhat earlier recourse to stimulants than has been advised by some writers; for I am confident, from my limited experience in this distemper, and from a more familiar acquaintance with the vascular excitement attending the earlier stages of other malignant fevers, that a judicious recourse to those remedies may be had much earlier in these diseases than has usually been advised. This fear of stimulants and restoratives has arisen from the rapid, tumultuous, and expansive state of the pulse; the restlessness, nervous excitement, and harsh heat of skin, so generally present, so frequently misinterpreted, and so injuriously treated by evacuants and other lowering remedies; the remarkable loss of power accompanying this state, and the morbid condition of the blood—circumstances strongly militating against such treatment—being entirely overlooked, or, if taken into account, being inaccurately estimated.

173. Anticipating, therefore, with more or less decision or activity the accession of vital depression in this stage, by commencing the exhibition of stimulants before the stage of excitement or reaction has altogether ceased, these medicines should be still more strenuously prescribed after this stage has actually supervened. In the fourth form of the malady, where vital reaction or excitement is very imperfectly developed, the treatment appropriate to this period should be employed without hesitation or delay. In several instances of the distemper which came under my care in Africa, I had exhausted the various combinations of camphor with nitrate of potass; of ammonia, ether, and aromatic spirits; and of cinchona, serpentaria, and capsicum, in the treatment of this stage, without deriving that benefit from them which I had expected. I then had recourse to the following: to warm clothes imbued with spirits of turpentine and kept constantly applied to the epigastrium, abdomen, and insides of the thighs; to brandy with an equal quantity of warm water, or in sago, arrow-root, or in spruce or ginger beer, &c.; to enemata with oil, spirits of turpentine, and camphor, or asafœtida; to camphor with capsicum, either in the form of pills or holus with opium, or rubbed up with olive oil and taken on the surface of some aromatic water, or spirits and water; to Madeira and other wines, either alone or with soda water and ammonia; and, when hæmorrhages and black vomit either were threatened or had appeared, to spirits of turpentine in various forms and combinations, and the results were certainly most beneficial, several cases having recovered that presented some of the worst symptoms of this stage of the malady. The quantity of wine or of spirits taken in some of these cases was most remarkable, and generally with no other effect than that of allaying the sickness and vomiting, and calming the restlessness, tremour, and delirium. It was often found necessary to the securing of a successful issue, in these cases, to repeat the stimulus frequently, and to continue the treatment for several days. It was remarked that thirst, heat at stomach, and anxiety were more certainly removed by these stimulants than by milder fluids, or by simple diluents. I have mentioned these means, having experienced their good effect; but it is very probable that the addition of *creasote* to some of them, as to the camphor, capsicum, and opium, and that the farther addition of the acetate of lead to the creasote and to these would have increased the benefit derived from them.

[As yellow fever assumes different types in different years and different latitudes, so, also, it requires modifications in the modes of treatment. Dr. IMRAY has alluded to this circumstance with respect to the disease as it prevails in the islands of Martinique and Dominica, which are both mountainous, and have a similar climate and temperature, and yet in the one, while blood-letting proved a most efficient and successful remedy, in the other it proved equally destructive, and had to be entirely abandoned. The same remarkable circumstance has been alluded to by Dr. NOTT, of Mobile, who witnessed five epidemics of yellow fever in that city in different years (1837, 1839, 1842, 1843, 1845), each of which presented some predominant peculiarity of type, and all demanded some modification of treatment. As a general rule, it is now admitted by American practitioners that yellow fever is not a disease which demands active depletion, and that the lancet is to be used with great prudence and caution, and only in the first stage of the disease. "If you determine to resort to it," says Dr. DICKSON, "place your patient half erect, make a large orifice, and draw from the vein at once a sufficient amount to make a forcible impression on the system. You will thus fulfil your purpose of the reduction of vascular excitement with the least absolute diminution of the original powers of action and resistance of the constitution." Dr. D., however, admits that, in the treatment of the ordinary inflammatory form of the disease, the first and principal indication is, to reduce vascular excitement, which is to be done by the most prompt and efficient means compatible with the well-being of the patient. "A few hours," says this experienced observer, "at the very commencement of the attack, comprises all the time allowed us for the hopeful application of our remedies, as we have to contend with scarcely any disease in which the vital powers are so soon crushed and overwhelmed beyond the capacity for resistance. The force of morbid

determination, too, is chiefly directed upon an organ at once of the utmost importance and of the greatest delicacy—the stomach—whose sympathies involve peculiarly the tone and energy of the whole system." And yet Dr. D. thinks that the lancet is by no means an essential or even general remedy in yellow fever. As a substitute, he prefers the cold bath, which, he states, is equally effectual in subduing morbid excitement and controlling irritation, without any positive expenditure of, or subtraction from, the vital forces. Cold water is to be freely poured over the patient—seated in a convenient vessel—in a large stream, until the heat of skin, thirst, headache, pain and irritability of stomach, &c., are abated; and this process is to be repeated as often as these morbid symptoms return. It is very probable that the cold, wet sheet would answer the same indications. Emetics are to be wholly proscribed. Mild purgatives, as of calomel, followed by oil or sulphate of magnesia, are considered indispensable by many, as the bowels are for the most part torpid. All bulky or nauseating formulæ will be instantly rejected. Dr. Dickson relies, in a majority of cases, upon the mercurial treatment, without the use of diaphoretics, persisting in free doses of calomel, until the patient has become better, or ptyalism brought on. "It is a matter of great importance," he observes, "that this shall be accomplished speedily, in order to arrest the destructive and rapid progress of this terribly malignant disease. Many and various are the measures proposed, with a view to hasten the excitement of the mercurial action in the system. Some rely on opium, as checking its purgative effect; some regard alkalies as specifically adjuvant. I am convinced that we shall succeed best by a judicious attention to the general symptoms. By the cold bath and the cathartic, affusions upon the vertex, and cups or mustard poultices upon the epigastrium, we relieve morbid local determination, and diminish diffused excitement; relaxing cutaneous constriction, deriving to the extensive surface of the intestines, whose vessels, congested and engorged, are unloaded by soliciting free mucous discharges." The prostration and collapse are to be met by quinine, or the infusion of cinchona with an aromatic, and a little alkali, as soda or potash; also by camphor and opium in properly regulated doses. Hæmorrhage from the bowels is said to be best controlled by nitrate of silver given in doses of one fourth to half a grain; also by enemata. Where there is an oozing of blood from the gums, pledgets, dipped in a strong solution of it, should be held in the mouth. Stimulants, as recommended by Dr. Copland, have generally proved entirely inert in this stage of the malady. *Capsicum*, in combination with opium, is undoubtedly one of the best. The *spt. terebinth.* will irritate the stomach, increasing the gastric distress, without accomplishing any useful object. In the last stage, most writers agree in the propriety of giving alcoholic stimulants freely, especially rum, or brandy in combination with milk, arrow-root, sago, rice gruel, &c.

Much attention has been recently paid to the effect of large doses of *quinine* in the treatment of yellow fever, not administered during a remission, but in the very incipient stage of the disease, before any local lesions have occurred. Our army surgeons at Vera Cruz, we understand, have recently employed this remedy with great success in this disease, in large doses, as thirty, forty, and even sixty grains, with the effect of producing a rapid subsidence of the violent symptoms, and speedy convalescence.]

174. iii. Remarks on various Methods and Means of Cure.—*A. Blood-letting.*—It is generally found that the usual mode of treating fevers, occurring to persons who have recently migrated to places within the tropics, sanguineous depletions—a mode generally found beneficial, and even necessary in young and robust Europeans—is not only inefficacious, but often highly injurious, even in those persons when attacked by this pestilence. The experience of Dr. Imray as to this very important topic is so accordant with my own, and with that of the most discriminating and judicious physicians, that I shall adduce it here in almost his own words. Although a few instances, he remarks, of recovery take place after blood-letting, yet the effect seems rather an acceleration of the fatal event. Where, from the onset, the pulse is feeble, and the prostration of strength extreme, the abstraction of blood is clearly contra-indicated; "but, on the other hand, when the patient is young and robust, the pulse strong, the skin burning hot, and gastric irritation constant, it at first sight seems evident that a prompt and decisive use of the lancet is urgently demanded; and yet, when depletion is carried to its fullest extent, the only good effects produced are but a temporary alleviation of the symptoms." When the blood is allowed to flow until faintness or actual syncope take place, the patient afterward expresses himself greatly relieved; the violent headache, pains in the back and lower extremities are removed, and the skin becomes cool and moist. This respite, unhappily, lasts but a very short time, giving place, after one or two hours, to a renewal of all the symptoms, perhaps in an aggravated form. If blood-letting be again practiced, the same result follows as from the first bleeding, "and to whatever extent it may be carried or however often repeated, no permanent impression is made upon the disease; but the stage of collapse is hastened, and the strength becomes much impaired by the loss of blood, rapid sinking being the consequence" (p. 85). It will generally be found more beneficial in cases of local congestion or prominent affection of an important organ, especially where moderate blood-letting is indicated, to have recourse to local depletions, by cupping below the shoulder-blades, or by leeches behind the ears, or in other situations, and to an amount which will be indicated by the circumstances of the case, than to resort to large bleedings from a vein.

175. *B. Mercurials*, more particularly *calomel*, have been much employed in this distemper since they were so strenuously recommended for it by Dr. Chisholm; but in this, as well as in all other malignant diseases, confidence in them, either alone or chiefly, will be followed by disappointment. In the West Indies and America, in the south of Spain, and in Africa, *calomel* has been given by many physicians for

the cure of this pestilence, in large and frequently-repeated doses, with the view of bringing the system under its influence as speedily as possible; but the difficulty of effecting this object was generally in the ratio of the severity of the malady. It is stated by Dr. Imray, that "the more malignant the symptoms the less probability there was of the calomel exerting its specific action; but even where this object was attained, the patient could never be pronounced absolutely safe, inasmuch as cases terminated fatally when calomel had been given in large quantities, and the system was decidedly under its influence;" and that, when the desired object of salivation was produced by enormous doses of calomel, "recovery, if it did take place, was much protracted, and intolerable sufferings inflicted on the patient. In the more malignant cases, the only approach to salivation was swelling and soreness of the gums, tongue, and throat, with a decided increase of the tendency to hæmorrhage from the mucous surfaces." There can be no doubt of the accuracy of these remarks as regards a recourse to frequent and large doses of calomel when given alone; but when full doses of this medicine are prescribed early in the disease with purgatives or cathartics, or when they are continued after free evacuations of the bowels, in conjunction with large doses of camphor, capsicum, and opium, a much more beneficial result is produced by them. I have had many opportunities of testing the effect of large quantities of calomel given alone in several malignant distempers, and have observed the general failure of the practice; but when the calomel was conjoined with equally large doses of camphor, capsicum, and opium, and employed, thus combined, early in the disease, the result has been very different, more especially when these remedies have been aided by the application of the warm epithems and frictions of the surface, and by the enemata already recommended (§ 166); recovery having very frequently taken place in most unfavourable cases and circumstances, and often without salivation having been produced. Much, certainly, was to be ascribed to the medicines conjoined with the calomel and to the rest of the treatment; but something certainly was also owing to this latter substance. I believe, however, that the effects of these conjoined means are much more beneficial than may be inferred from their individual operation, not only in removing the irritability of the stomach and internal congestions, but also in restoring the secretions and excretions, and in calming the perturbation of the nervous and vascular systems. The quantities of those substances which I have prescribed, and the intervals between the doses, have varied much with the character and nature of the attack; but I have given from 5 to 20 grains of calomel, with 3 to 15 of camphor, 2 to 5 of capsicum, and from one third of a grain to one grain of pure opium every four or six hours; and in some instances, where it was not necessary to give the former of these substances so frequently, I have prescribed even a larger dose of the opium.

176. *C. Purgatives* are required in all the forms of this pestilence, and more especially early in the attack, not merely for the evacuation of accumulated morbid secretions and excretions, but also for the promotion of the functions of the liver and intestines, and the selection of them is generally a matter of some moment. A full dose of calomel may be given with jalap or the compound extract of colocynth, and half a drop or drop of croton oil, and he followed by the infusion of senna, with a neutral salt and an aromatic tincture, and shortly afterward by the oleaginous enemata already advised (§ 164, 166). These will he less apt to offend the stomach if one or two drops of creasote be added to each dose. The quantity of calomel may vary from 5 to 20 grains, and may be taken with the other ingredients in the form of bolus or of pills. After the free action of these, the frequent recourse to sweet oil, in the earlier stages, and of this oil with spirits of turpentine in the last stage, as noted above (§ 166, 173), aided by enemata, will generally procure a sufficient evacuation of the bowels, more especially if calomel be given with camphor, capsicum, and opium, as already mentioned (§ 175).

177. *D. The irritability of stomach*, so constantly attending the disease, is not only a distressing symptom of itself, but is one interfering remarkably with the exhibition of medicines, and preventing their retention by the stomach and passage into the intestines. In order to allay this state, various means have been devised. Blisters, bleeding, opium, effervescing medicines, &c., were those most commonly had recourse to when I visited intertropical countries in 1817 and 1818; but I soon perceived their general inefficacy. Bleeding often aggravated, although it frequently mitigated for an hour or two, this symptom. Blisters produced only a very temporary effect. Effervescing draughts occasioned a more rapid and complete evacuation of the stomach, and often a painful reaction of this organ upon the distention produced by the fixed air. Opium often produced no sensible effect when given alone, or with fluids, it being generally thrown off; I therefore gave it with full doses of calomel and capsicum, and found great benefit derived from it. The beneficial influence of these upon the state of the stomach was much promoted by the application of turpentine epithems over the epigastrium and abdomen. In the first and second stages of the distemper these means will often prove most serviceable; and very probably the addition of *creasote* will farther promote their efficacy, not merely in these stages, but also in the third stage, when the antiseptic and anti-emetic properties of this substance are so remarkably required. In this last stage, it is remarkable that the vomitings are more completely allayed by a most nauseous medicine, viz., by the spirits of turpentine, than by any sedative or narcotic, especially when taken on the surface of milk or some aromatic water, &c. The irritability of stomach in the slighter cases is often removed by means of almond emulsion, or of sweet oil with calcined magnesia and small doses of tincture of opium, taken after short intervals, especially when these are aided by the turpentine epithems on the abdomen and purgative enemata (§ 166).

178. *E. Tonics, stimulants*, and *antiseptics* are severally more or less serviceable in this dis-

temper, but I believe that they are rarely prescribed in sufficient quantity to make a due impression on the system in its existing state of vital depression.—*a.* Formerly cinchona, in various forms, was employed, but was either inert, or not retained on the stomach unless conjoined with camphor, or ammonia, or capsicum. I have given it in substance, in large doses, and in these combinations in as much as half a pint of Madeira, in malignant remittent fever, with great benefit; but in this distemper it is neither so frequently retained by the stomach, nor so beneficial when retained. The sulphate of quinine is now substituted with great advantage in the former disease; but it has been found much less serviceable in the pestilential distemper. Dr. Imray states that, while the stage of excitement lasted, no opportunity was afforded of exhibiting quinine, and when this stage subsided, and that of collapse came on, it was completely inert, even in the largest doses; and he adds that it was also equally inefficacious in arresting the malady if given at the commencement of those cases which were accompanied with extreme vital depression. There can be no doubt of its general inefficacy in the last stage, and even early in the fourth form (§ 11) of the distemper; for, in these states of vital exhaustion, it is either imperfectly, or not at all, dissolved in the stomach, even when retained; and even granting that it is dissolved, the degree of depression is so great as not to be roused by it alone. Hence the bark in substance, taken in wine, with ammonia, capsicum, &c., as mentioned above, would be preferable, if it were retained by the stomach. I would advise that quinine should be given earlier in the disease than it usually has been, if given at all. The existence of vascular reaction ought not to delay its exhibition, which should be directed in full doses, and generally conjoined with camphor, capsicum, and opium or creasote, or both, according to circumstances; for it should be recollected that, however tumultuous and excessive vascular action may seem, vital power is so deficient as to render tonics and stimulants indispensable to the reduction of such excess.

179. *b.* Mention has been made (§ 173) of those *stimulants* which I have employed in this distemper. In one case, to the notes of which I have referred, I find that somewhat more than two bottles of brandy were taken within twenty-four hours in the treatment of the period of exhaustion, besides some Madeira, the patient having rallied and ultimately recovered. Dr. Imray states that few stimulants were found to answer so well as Champagne. "If any irritability of stomach remained, a greater or less quantity of this wine, sometimes as much as half a tumblerful, was given every hour or half hour, alternated with farinaceous food containing brandy; and in some instances the quantity of stimuli taken, with merely the effect of warding off impending fatal sinking, was truly surprising." The circumstance most to be dreaded, and, indeed, to be prevented by an earlier recourse to stimuli than is usually advised, is exhaustion of the vital power of the stomach, so as to be past being influenced by this class of medicines. If, however, the cold, clammy feel of the body and the sinking of the pulse have come on before stimulants are administered; and if the pulse rise in strength, and if a glow of returning warmth be diffused over the surface, the best hope may be entertained of the patient's recovery, notwithstanding the late period at which they have been exhibited; but the strictest care will be required for several days to prevent symptoms of sinking from supervening. *Brandy*, *Madeira*, *hock*, &c., taken in soda water, generally with the addition of the sub-carbonate of soda, or carbonate of ammonia, or in spruce beer, Seltzer water, &c., or the former in arrow-root, sago, &c., are generally of service in the more severe states of the malady, and when the stage of excitement is about to pass into exhaustion.

180. *c.* Of medicinal stimulants, *camphor*, *ammonia*, *capsicum*, &c., are most deserving confidence in this malady, especially when conjoined with *opium* and *aromatics*, or with the preparations of cinchona. *Spirit of turpentine* is, however, the most generally applicable, as respects both the state and stage of the distemper and the modes of administering it; and it is even more certainly beneficial when given during the stage of excitement, especially conjoined with other oils, so as to act freely on the bowels, and administered in enemata, as noticed above (§ 166, 173). When the stage of exhaustion is approaching, or has supervened, and indications of passive hæmorrhages or black vomit appear, it then should be prescribed in smaller and more frequently repeated doses, with small quantities of tinctura opii, capsicum, or other aromatics, and administered largely in enemata, with camphor, asafœtida, &c., or with tinctura camphoræ composita. Much of the advantages derived from this substance result in this as well as in other malignant diseases from the mode of prescribing it, according to the varying states of morbid action; and the modes most appropriate to these states are to be learned only from attentive observation of its effects in various circumstances. It will be more easily retained by the stomach when vital depression is very remarkable, if a drop or two of creasote, or of cajeput oil, or of tinctura capsica, be added to each dose.

181. *d.* The use of *antiseptics* in this and other malignant diseases was more generally adopted by the older than by recent writers. The humoral pathologists recognised the virtues of those substances which possessed antiseptic properties; but with the adoption of the doctrine of Hoffman and Cullen, the possibility of antiseptics proving serviceable was disputed and even denied, because they believed that benefit from these substances was inconsistent with their doctrine. Thus an important class of medicines for the most dangerous states of disease was sacrificed to a theory, and the results of sound and close observation were despised, because they could not reconcile them with their limited views. Many of the substances which act as stimulants act also as antiseptics, and serve to prevent the tendency to a dissolution of the vital cohesion of the tissues, and of the crasis of the blood, characterizing the malady, and manifesting itself even before life is extinct. The preparations of *cinchona*, *camphor*, the *chlorides*, the *chlorate of potass*, the *terebinthinate substances*, *creasote*, *aromatics*, &c., severally exert not only a stimulating influence on the vitality of the frame, but

also an antiseptic effect not merely on the digestive mucous surface, but also upon the whole body, by imbibition and absorption into the circulating fluids, if the exhibition of them has not been delayed until the powers of life are sunk too low to be impressed by physical agents. The cause of the failure of most of these agents in pestilential and malignant distempers is often to be attributed either to the late period of the malady in which they are prescribed, or the inadequate doses in which they are given.

182. *F.* With the *chemical pathology* of West Indian fevers, Dr. STEVENS introduced a different practice in their treatment from what had hitherto been adopted; but, as might have been expected by those who have studied the laws of living bodies, in connexion with those displayed by inert matter, the practice has not justified the praise lavished on it by its author. The chemical doctrines of LIEBIG, with reference to physiology and pathology, have tended to impart much greater importance to a purely chemical treatment of disease than might otherwise belong to it; still, chemical agents, as aids to the due development of the controlling influence of life, ought not to be overlooked, but should be rationally employed, under the guidance of observation and experience. The important truths, that the chemistry of living bodies is not the chemistry of inert matter; that the vitality of the body develops a vital chemistry of its own, and controls the chemical actions of material elements to its own ends; that it is only the deficiency or loss of vitality that allows purely chemical actions to be manifested, while the due ascendency of this principle converts them from their natural and purely chemical tendencies, and directs them to its own purposes; and that due energy should be imparted to this principle when we wish to develop those chemical changes which are strictly vital, and which are indispensable to the continuance of animal existence—ought never to be lost sight of in our speculations on the treatment of malignant and pestilential distempers, and should be made the basis of our indications of cure.

183. Dr. STEVENS justly stated that the colour of the blood was changed in the more malignant cases of fever; but he was not equally correct as to the loss of the saline ingredients of the blood, nor even as to the cause of the loss of the colour of this fluid. The still more important loss of the fibrin of the blood had not its proper place assigned to it in his appreciation of the changes evinced by the circulation. Believing that the alteration of the blood arose from the loss of the saline ingredients, he prescribed the neutral non-purgative salts, viz., the *chlorate* and *nitrate of potass* and the *carbonate of soda*, at short intervals and in moderate doses, and confided in them entirely. There can be no doubt of changes in the blood occurring in the course of the disease; but these changes are not of a purely chemical nature; for, even admitting that a partial deficiency of the saline ingredients of the blood is actually present, it is evident that this deficiency arises rather from a want of an accustomed supply of these ingredients during the course of the disease than from any increased loss or waste of them, as shown in another place. They are strictly a part only of those changes which depend upon the state of vital influence, or of organic nervous power in the several viscera; the deficiency of fibrin being even greater and more remarkable than that of the saline ingredients. The treatment of Dr. STEVENS, as well as his pathology, was too exclusively chemical to be consistent with actual morbid conditions. He saw a portion, and that but a small portion, of the mischief; yet that little was large enough, in his eyes, to intercept the view of much more important truths. The puny progeny of his mind was rapidly nurtured by his imagination into premature and gigantic growth, but like all objects attaining large dimensions prematurely, it wanted the vitality necessary to endurance. While he unwarrantably magnified changes which he considered to be chemical, he mistook their origin, and entirely overlooked those which are vital, which depend upon the state of vital endowment. He did not even appear to recognise any alteration that was vital. What was most prominent and unmistakable was altogether hid from him. The highly diseased condition of the blood was sufficiently obvious; but it was also equally obvious that the alteration was much more vital than chemical. Dr. STEVENS's theory, failing in support from observations and experience, has fallen "like an inverted cone." Dr. IMRAY thus states the results of the treatment which was based upon it: "Unhappily, the salutary change said to be effected by the action of the neutral non-purgative salts did not take place, as may be inferred from the malignant symptoms continuing unabated. Notwithstanding the exhibition of these salts in large doses, and the administration of the carbonate of soda, muriate of soda, chloride of soda, nitrate of potass, &c., variously combined, yet in no instance in which they were prescribed could it be said that they produced any marked effects, either in preventing malignant symptoms, or in removing them after they had made their appearance."

184. The inefficiency of this treatment has partly been owing to the erroneous views entertained by its author respecting it, and to the circumstance of its being confided in solely, to the neglect of other and more important remedies. If certain of these salts had been employed as adjuvants of other means in states and combinations appropriate to existing morbid conditions, I believe, from my experience of them in other malignant distempers, that more benefit would have been derived, especially if they had been prescribed before the vital powers were too far reduced, and before the consequent changes had proceeded too far to be influenced by them. The *chlorate of potass* was recommended many years ago by Dr. GARNETT and others; and for more than thirty years I have employed it in the low adynamic states of fever, more especially in malignant scarlet fever, with carbonate of soda and *hydrochloric ether*, in the decoction of cinchona or the infusion of valerian; combinations which, with some modifications or additions, might be prescribed with advantage in this pestilence, if not delayed until a too advanced period.

185. *G.* The *external means* which offer the most advantages are, during the first or cold stage, or that of horror and invasion, the warm

bath, followed by frictions of the surface with warm olive oil, and sinapisms or turpentine embrocations over the epigastrium. When the period of excitement and vascular reaction has supervened, the hair should be removed from the head, and cold applications, or the cold affusion, be prescribed, and repeated or continued according to circumstances. The tepid hath, or cold sponging of the whole surface, is generally as beneficial as it is grateful to the patient in this stage ; and when either the one or the other is followed by frictions of sweet oil, a copious and general perspiration usually supervenes, and proves critical, especially when aided by the warm sudorifics, particularly the liquor ammoniæ acetatis, spiritus ammoniæ aromaticus, and the æther hydrochloricus, or spiritus ætheris nitrici, as advised above (§ 164). In the last stage, and even early in the fourth form of the distemper, the external applications should be of a different kind from those required in the second stage. Warm and rubefacient substances are now required, the same means as are advised in another part of this article being also the most appropriate in these states of the distemper. (*See* PESTILENCE, CHOLERIC, § 179, 180.)

186. *H. During convalescence* the utmost care is requisite to prevent a relapse, especially into that state of dangerous exhaustion or depression marking the third stage and the fourth form of the malady ; a relapse being the more to be dreaded the earlier the period of convalescence, and the more liable to occur when the patient has been rescued from sinking by recourse to powerful stimulants and restoratives ; for in these cases the too early suspension of these remedies allows the distemper to resume that course which had been arrested only for a short time by their aid ; for if they be altogether or even partially relinquished before the secretions and excretions are restored, and the condition of the blood very materially improved, the disease returns, the morbid actions characterizing it being only suspended for a while under the influence of the agents which had been administered. When convalescence is farther advanced, the distemper having altogether ceased, recovery generally takes place more or less rapidly without any disposition to relapse, unless errors of diet, excesses, or most injurious exposure to noxious influences have occurred ; and even in these cases it is doubtful whether or not the consecutive disease is the same as that from which the patient had recovered ; for it must be obvious that a patient convalescent from this distemper cannot be exempt from the operation of malaria, or of other causes of disease, but, on the contrary, more likely to be affected when exposed to them, owing to existing debility and impaired resistance of vital power to injurious agents. During convalescence from this as well as from other pestilential maladies, very nearly the same measures may be adopted as have been advised in another place, with such modifications as the circumstances of particular cases may suggest. (*See* PESTILENCE, CHOLERIC, § 215–217.)

[APPENDIX.]

For the following valuable notes on the yellow fever at Vera Cruz, &c., we are indebted to the kindness of P. S. TOWNSEND, M.D., the able author of the work on this disease, so often quoted, and the well-known translator of VELPEAU's Operative Surgery.—(ED.)

YELLOW FEVER AND OTHER DISEASES OF THE AMERICAN TROOPS, SAILORS, AND MARINES AT VERA CRUZ, NEW-ORLEANS, LAFAYETTE, MOBILE, TAMPICO (?), &c., 1847.—PREVAILING DISEASES OF THE AMERICAN ARMY ON THE TABLE-LANDS OF MEXICO, AS AT JALAPA, PEROTE, PUEBLA, MATAMORAS, CAMARGO, MONTEREY, &c.

During this present summer of 1847 there have rapidly occurred in the Gulf of Mexico some of the most instructive lessons on the subject of the origin and communicable, transportable or importable, and contagious and infectious nature, and specific *sui generis* character of yellow fever (as contrasted with other diseases), that are to be met with in the history of this disease. These facts have resulted from the present war of the United States with Mexico, and the extensive and sudden accumulation, within the tropics, of bodies of troops, and sailors, and marines, almost exclusively, or at least *two thirds* of them, unacclimated, robust northern men, and employed on various expeditions against the Mexican seaports and interior towns. During the past spring some 15,000 to 20,000 volunteer troops and regulars, mostly from our northern and western States (Illinois, Indiana, Ohio, Mississippi, Kentucky, Tennessee, Pennsylvania, and New-York), together with a naval fleet of one 74, several frigates and steam-frigates, sloops of war, brigs, gun-boats, and small steamers, manned by four thousand seamen and marines, assembled before Vera Cruz. The volunteers and regulars were brought thither chiefly by the way of New-Orleans, in a short run of a few days, in United States steam-transports and other craft, as ships, brigs, &c., and some from ports in the middle and northern states. The *transports alone* that carried the troops, first to Tampico, but chiefly to the island of Lobos, near Vera Cruz, and soon after to the anchorage of Anton Lizardo, within five to ten miles of Vera Cruz, where our naval armament were moored, amounted to near 150 or 200 vessels, chiefly of large dimension, and a considerable number of which were steamers. The entire coast of the Gulf of Mexico, from the mouth of the Mississippi River to Vera Cruz (lat. N. 19°), was, for the first time in history, alive with *crowded* expeditions, chiefly of *northern men*, and *all* natives of high latitudes or extra-tropical countries.* All this occurred for the most part in the beginning of March, and about the middle of that month Major Gen. SCOTT landed from our squadron, in the space of a few hours, some 15,000 of these raw northern troops, including a large battalion of marines, upon the strip or margin of *gravel*, *sand*, and *sand hills*, which here, for miles and miles, forms the coast of Mexico, in the midst of which arid spot, *perfectly destitute of all marshes*, *lagoons*, or *malaria*, Vera Cruz is situated. During all these embarcations, transportations, and debarcations, whether at Tampico, just

* Though *four fifths* of the soldiers and sailors were Americans from latitudes north of 34° N., the other fifth were almost exclusively Irish, with a few Germans.

without the tropics, or at Lobos or Vera Cruz, both in about 19° N. lat., scarcely a single soldier, or sailor, or officer died of any disease or fever whatever, though all were of robust constitutions, well fed and well clad, many of them (as the volunteers) *wealthy* farmers, and all unhabituated to a tropical climate, and most of them thus brought, by the aid of steam chiefly, *suddenly* into the neighbourhood of Vera Cruz, within a month after leaving their northern homes. In all this time *not one died of yellow fever*, although the temperature during March and April was, for the greater part of the time, ranging above 80° F. More than this, the troops before and during the bombardment of Vera Cruz, and at the time of the surrender of that town and of the Castle of San Juan de Ulloa, and afterward, lay for a month in their encampments of tents on the sand-beach without the city, a few only being quartered within the walls of the city and castle for garrison duty. After this, the army proceeded on its march on the great public road, through dense forests and shrubbery, called chaparrals, constantly ascending rapidly above the level of the sea, capturing on their route Cerro Gordo, the city of Jalapa, Castle of Perote, and, finally, the city of Puebla, on the vast table-land or plain of the Valley of Mexico, which plain is itself 100 to 200 miles in diameter, and upon an average of 7000 to 8000 feet above the level of the sea, besides being surrounded by an amphitheatre of mountains which, many of them, are 8000 feet still higher above that plateau.

The army have here since (*i. e.*, up to our writing, September, 1847) enjoyed almost uninterrupted health, finding themselves in a pure, brilliant, elastic atmosphere of diminished density, and which, though it may be said in that rarefied condition to be tropical, and is geographically within the tropics, possesses, however, a uniform mildness of temperature which belongs to extra-tropical regions, but of much more salubrity than upon extra-tropical parallels of similar temperature. The only diseases that have prevailed here have been incidental to exposure to the rank vegetation on the march, irregularities, and excesses in diet and liquor, exposure to night air, and indulgence in the mixed tropical and northern fruits, always accessible in these places ; and hence the diarrhœas, dysenteries, and intermittents, and some remittents ; but *no* yellow fever or vomito.

Previous to the army leaving the coast, and while being concentrated during February and March at Vera Cruz and the neighbourhood, the entire Gulf of Mexico in this portion of it was almost daily swept by those refreshing, and even in this season often unpleasantly cool and fierce breezes called "northers," or heavy blows from the north, often, as occurred this summer, augmenting to destructive tornadoes to the shipping at anchor or near the coast, but serving as most thorough purifiers and ventilators against the possibility of any lurking contagion or infection.

Hence, while these continued, viz., up to the beginning of May, the full-blooded, sanguineous northerner, with his rich animal blood, wholly escaped the *de novo* production of vomito in his system ; for the other element, inter-tropical heat, was nullified in its operation by the cold winds named. The city of Vera Cruz, though naturally a dry, clean, well-laid-out place of some 7000 inhabitants, is surrounded with high walls which completely exclude all ventilation. The reflected and reduplicated irradiations of heat, untempered by the northern blasts, placing Vera Cruz in a condition similar to the shut-up harbour of Havana, with its immense battlement of the Moro Castle and Cavana opposite (200 feet high and a mile long), making it a perfect oven, now made the Mexican seaport also begin to feel the force of this suffocating atmosphere. The disease, of course, began to appear sporadically, or in isolated spontaneous cases, successively among the combustible materials there fresh for its reception, viz., among the few northern troops left (after the departure of the great body of the army) to garrison the city, in which garrison duty were included the various northerners employed in the quartermaster's department, or as teamsters or sutlers, &c. To this concentration of *heated human effluvia* was doubtless superadded the offensive putrid exhalations from bodies crushed beneath the falling buildings, walls, &c., and which must have amounted to a considerable number, as several hundred of the Mexicans were killed in this way through the bursting of the vast number of heavy, destructive shells sent by our artillery and naval batteries in the intrenchments during the bombardment which resulted so gloriously to our arms. A greater portion of these smouldering ruins and decaying bodies, however, were speedily removed by the vigilance of our commanding officers in garrison (Gen. Worth, Col. Wilson, &c.).

Meanwhile, though the disease, after being once generated, as I have mentioned, within the heated atmosphere of Vera Cruz, naturally reproduced itself in others by its infectious or contagious germs, it was, by a vigilant police, ventilation, disinfection, and therapeutics, instituted under Dr. Barton (President of the Board of Health of Vera Cruz), prevented from becoming epidemic. And in the famous Castle of San Juan de Ulloa, only a mile distant, and where there was only a small garrison, and spacious shaded apartments, and cleanliness, and thorough ventilation and dilution with the sea-breeze, not a solitary case, we believe, of the vomito occurred. The fever soon declined also even in the city. The reason why we shall see.

To exhibit, however, this most important point of *atmospheric dilution* in all prophylactic or preventive and purifying measures, take such facts as these : In consequence of Gen. Scott finding himself at Puebla, in the interior, greatly embarrassed by his communication being cut off with Vera Cruz, on the coast, owing to the large bodies of guerillas or rancheros that infested the road, it became necessary to keep this route open or cleared by correspondingly adequate forces of American troops. Bodies of American soldiery, therefore—almost every one raw recruits from the north—have been constantly arriving at Vera Cruz all the months of *May*, *June*, *July*, and *August*, and have successively encamped outside the city, on the extensive beach before mentioned. Here they have, almost all of them, remained encamped in their tents for near a month, as force after force was successively marched up

to Jalapa and the interior. Thus the forces of Generals Pillow, Cadwallader, Pearce, &c., each from 1500 to 3000 men, with large trains of ammunition and provisions. And yet, while encamped in their tents on the beach at this hottest season, where the "northers" had ceased to blow, scarcely a solitary soldier of the whole of these troops has perished of vomito! The under parts of the tents being open to free currents of air constantly, and the tents themselves being judiciously separated, and so located as to favour this thorough ventilation and dilution with the external atmosphere, during the alternate land and sea breezes, night and day, and also the *now* (in the summer months) constant range of the thermometer, night and day, at a very small distance from 90° Fahr. either way, are wholly sufficient causes for the solution of this problem. It is, on the other hand, and in corroboration of what is here asserted, to be remarked, that the yellow fever (from what has yet been disclosed) began now, in the month of July, to make its appearance also on board of the squadron under Commodore Perry, lying, as before, more or less of their time constantly at the anchorage of Anton Lizardo, some five to ten miles south of Vera Cruz. These cases occurred successively, and chiefly on board the Mississippi steam-frigate; and we explain its special occurrence here in one or some, or all of the following modes: 1. Her ship's crew consists of three to four hundred, and hence below decks, ventilate as we may, there must be far more crowding, and also, therefore, far greater concentration and accumulation of human effluvia than in the smaller craft which have only small crews. 2. Sailors generally (especially when off duty) are more dissipated, and more ready to indulge than soldiers in excesses of drink, fruits, &c., exposure to the hot sun on shore, fatigue, &c. 3. Though the temperature of the atmosphere on shore was *now* at this season too high (as during the "northers" it was too low) to co-operate with the rich blood of the newly-arrived northern man in the *de novo* production of yellow fever, it was in the *shipping* less elevated, viz., probably ranging below decks from 85 to 88°, and at the same time converted into a most combustible medium or nidus both for the germination and for the re-propagation of yellow fever. 4. Doubtless some of the disease on board was introduced by communication of the crew with the garrison and city of Vera Cruz.

A curious episode, however, occurred in the midst of this exposure, and during the gallant services of our naval armaments; and it proved for them doubtless a most fortunate one. For, by the activity of the commodore and his officers, constant expeditions during these hot months have been planned and executed to bring to submission the various other seaport towns, mostly small cities, on the small rivers that open on this part of the coast.

Among these, and by far the most important undertaken by Commodore Perry (Tampico and Tuspan having fallen early in the campaign), was Tobasco, in July. Marines and sailors were detached in large draughts from all the vessels of the squadron, both from those left at Anton Lizardo and from those that constituted the expedition to the mouth of the Tobasco River. These forces, nearly 1200 in number, were, on account of the current and shoals, two days nearly in ascending some 150 to 200 miles, to the small town of Tobasco, though towed up in a masterly manner by the small steamers of the squadron. All the accounts represent this winding stream and its tributaries to be margined with the very heaviest growth of rank vegetation, which at the time was in its highest state of luxuriance, and masses of it macerating and decaying in the humid places along the banks. The sailors, in capturing the town of Tobasco, had first to land and make fatiguing, rapid marches in the hot and broiling sun, in the midst of exuberant masses of chaparral, and vines, and trees, and underbrush, literally cutting their way through these entanglements. They then returned to Anton Lizardo, leaving only an inconsiderable garrison, which in a few days being re-enforced to nearly one third the original expedition, thence proceeded on foot farther up the river, encountering in their tedious and difficult march the same kind of obstacles as before, and captured another small town, to which also a force of small steamers afterward went up for the same purpose.

Together with such expeditions and exposure to the most intense malaria and a hot sun, among streams of fresh water clothed in submerged vegetation, we should remember that our sailors and marines also had, a few weeks previously, executed similar expeditions up similar rivers, as to Alvarado, Tuspan, Laguna, &c., under Tatnall, Mayo, Hunter, &c., directed mostly in person by Commodore Perry. It is sufficient to know that the *naval forces* left on the Mexican coast, and thus operating in the midst of the spring and summer months, were thus constantly on the move, and fearlessly breasting, on this tropical shore, every kind of hardship and danger; the greatest of which was that of having been compelled, as already remarked, to encounter the deadly *paludal malaria* of the mouths of the rivers.

What was the consequence? About the same time that the rigid police and cleanliness of the squadron, while remaining at anchor at Anton Lizardo, in every respect the same dry, healthy, and sandy shore and beach as at Vera Cruz, was, so to speak, "*staving off*" the vomito, or having only an occasional sporadic case among the crews not on the expeditions named, these last began, at the places they had captured, to yield to the influence of morbific causes, which, though naturally less fatal, were far more virulent than any element of the vomito, so far as regards, at least, their *epidemic* or atmospheric extension. This was the *malaria* or paludal exhalations mentioned, of which more than *two hundred and fifty* became sick almost simultaneously, or in large numbers successively. That they should have thus fallen sick together was to be expected as a matter of course, where all were alike exposed to a general and wide-spread vegetable poison. The 60 to 70 marines finally *left in garrison* on the Tobasco river were, it is asserted, every one of them taken down. This was to be anticipated, from their remaining several weeks constantly in a situation where they were compelled to breathe in the paludal poison diffused so abundantly through the atmosphere. All these invalids

were now successively brought down to the anchorage at Anton Lizardo; and the utmost astonishment was manifested by those unaccustomed to tropical climates and to vomito, in perceiving that nearly every one of the above cases of *paludal remittents* recovered, while those at Vera Cruz, and the very few on board the squadron that had been seized with *vomito*, almost invariably died. Such facts afforded but poor consolation to the blind theorists who had luxuriated in the scholastic absurdities of Rushian dogmas, that the *vomito is not a* specific idiopathic disease, but identical with *paludal* or *hepatic* disease, in other words, with *bilious remittents*. What is more, some of these very returned men of the expeditions, enervated by these remittents, now caught (by infection, doubtless) the vomito on board the Mississippi (little of it as there was), and died of it! Out of the company of marines just named, and who, from their continued exposure at Tobasco for weeks, naturally had the severest grade of remittent, only six or seven, nevertheless, perished of it, and of these probably two or three, or more, may have been cases of vomito caught on her arrival at the anchorage. In the forepart of August, in consequence of the great numbers sick on board the Mississippi of *remittents* among those who had been on the expeditions named, Commodore Perry, who had previously shifted his flag to the sloop-of-war Germantown, despatched the frigate with the invalids, some 150 in number, to our naval station at Pensacola, in Florida. There they arrived in a few days, and almost every one of them became rapidly convalescent as soon as the frigate had put to sea, and proceeded north before she reached her destination. So much for the *purer, cooler sea air* in the tropics in its salutary influence on the *remittent type* of disease. Not so with the vomito: the cases of this last almost invariably multiply at sea on leaving a hot port, as Vera Cruz or Havana, at this season; for there is necessarily more or less crowding below decks, and the cooler oceanic temperature, by its constricting effects on the surface [see my various works on yellow fever], favours the retention and more energetic action of yellow fever poison. The truth of this is seen every year.

While the masses of troops, sailors, and marines have been assembling and operating, as above described, on the tropical portions of the coast of Mexico, at Tampico, where we have also constantly had a garrison since early in the spring, and where, also, a similar expedition to that of Tobasco (viz, under Colonel De Russy) were similarly exposed to the malaria of the River Panuco, remittents, it is true, and diarrhœas and dysenteries, as among all our troops and garrisons, have been prevailing (not, however, mortally), while scarcely a case of the *vomito* occurred! Tampico is considerably *without the tropics*, and located in a healthy position, though far less so in respect to paludal exposure than Vera Cruz.

Also the other great arm of our service, viz., that under General Taylor, on the Rio Grande, has been, during the above period of the present spring and summer, receiving very considerable re-enforcements, also chiefly of northern men (volunteers or regulars), and mostly by the way of New-Orleans. These re-enforcements landed all at or near the mouth of the Rio Grande, at Brasos, Matamoras, &c., all of which are in about latitude 26° north. Here, also, and at Camargo and Monterey, higher up, more or less paludal fevers, diarrhœas, and dysenteries occurred, and some, from neglect or imprudence, proved fatal; but there was no mortality, and, least of all, no *vomito whatever*. The higher up the Rio Grande the more intermittents apparently occurred, and fewer cases of remittent type. So, in general, the juxta and intra-tropical positions, from the greater heat and greater intensity of malarious poison, and the greater activity of the liver and secretion of bile, furnish the most severe grades of remittent or bilious remittent. The malaria, as we see above at Tobasco, acts then so powerfully in its deadly poison, as to *occlude* the reaction of those elements that generate yellow fever, which elements, however, where the paludal poison is wanting, as at Vera Cruz, &c., then obtain the ascendancy. The whole subject, we repeat, is most instructive, and most emphatically significant of the type of the two diseases, and of their causes, symptoms, &c.

Finally, the vomito having now been fairly established at Vera Cruz from, as it were, imperious necessity, by forcing it into existence, by the large numbers from the north landed there, and latterly remaining under the most favourable circumstances, the disease thus obtained a new and more powerful auxiliary generating focus than it has at that city for many years.

New-Orleans, whose authorities have generally seemed to conclude that it would be more disastrous for her great commerce with the tropics to be sacrificed than to incur the risk of imported yellow fever by a lax code of quarantine, has thus acquired this year, through her patriotic co-operation in the Mexican war, not only active and direct means of introducing the foreign tropical pestilence by a return from Vera Cruz of the transports that carried troops and provisions, but also her customary supply of yellow fever infection in the short transit of her trading vessels from Havana, by which last-named market she is usually furnished with this pestilence.

The consequence has been that, through these prolific sources, the disease manifested itself at New-Orleans a few weeks subsequently to the first cases of our countrymen that were announced as its victims at Vera Cruz in June and July, or on the passage thence to New-Orleans. Meanwhile it was, as a matter of yearly and familiar occurrence, being introduced as usual at the wharves or levee at New-Orleans by daily vessels from Havana, &c. In the beginning of July it was no longer possible to *blink* the question, and since then its march has been one of longer and longer strides, and of a most frightful desolation, insomuch so that, in the beginning of September, even the *official* annunciation of deaths was acknowledged over *one hundred* victims daily! Gentlemen just from thence declare it never was so fatal, and they assert that the deaths daily are probably much nearer 150 than 100. This, too, it must be borne in mind, is in a population which at this season, by the customary migration of the richer classes to the north, is reduced to some 40,000 or 50,000 souls! At this rate our pres-

ent population in New-York, of 450,000 to 500,000 inhabitants, should lose by the vomito about 500 to 600 souls in every twenty-four hours!

We learn from credible sources that, as usual, the vomito has fallen with most severity on the poor emigrants (Irish and German chiefly) recently arrived within a few weeks from northern Europe, and who die, many of them, from pure neglect, and from having no means of escape to the country. It is inconceivable that the New-Orleans authorities should have culpably neglected to disperse their population bodily into the country. Even thinning out these emigrants in this manner would have done much; but the concentration of human effluvia has given a wild ferocity to the epidemic character of the pestilence. Finally, the intensity of the accumulated virus has reached the native Creole inhabitants, who will still, however, indulge the delusion that, in their latitude of 29° 30′ north, they can acquire a tropical immunity to yellow fever! They, too, have fallen victims. And, to wind up the tragedy, for which, for the sake of the country and the war in which we are engaged, New-Orleans must, this year at least, be forgiven, the *vomito* has, after the disease had raged for some weeks at New-Orleans, been, as might have been anticipated, carried across the Mississippi River, from that capital to the town or village of Lafayette opposite, and there proved alarmingly fatal; while, at the same time, the disease has been fairly and clearly introduced also to a greater distance from the same focus, viz., into Mobile. So successively other towns on the Mississippi, in communication with New-Orleans, will successively become entangled in the chain of infection.

Surely no one at this day will ever be so infatuated as to say that there has been anything in the atmosphere at New-Orleans, or in any part of the United States, of an endemic or indigenous character, either as to river or wharf mud, or alluvium, that could have possibly warranted the suspicion that so fatal a pestilence would this year have afflicted that devoted city. It would be folly, after looking back at the natural links that connect the whole of this subject together in the Gulf of Mexico, to argue with persons of this description.

We will make one or two concluding remarks: 1. Its very fatality clearly demonstrates the truth of all our positions; for it is the subdued character of the temperature by day, and the interregnum of cool nights that succeed, which furnish precisely that condition of things which, with the crowding together of northern and ever-unacclimated subjects at hand to feed upon, makes the disease imported into New-Orleans, outside the tropics, so fatal there at this moment, as compared with its apparent suspension (both de novo and epidemic) at Vera Cruz, within the tropics, by excessive continued heat. 2. While this note has been going through the press, we have had a striking additional fact in support of the infectious or contagious and transportable character of the yellow fever, in the *actual importation* of the disease into Brasos, only three degrees outside of the tropics, in one or more infected transport vessels from New-Orleans, in lat. 29° 20′ N.; together with the information that our military authorities at Brasos interdicted the admission of such infected shipping. 3. *One solitary case* only of the vomito, and proving fatal, has occurred in the Castle of San Juan de Ulloa, in Major Clarke of the army, who doubtless took the infection at Vera Cruz. 4. The prevailing diarrhœas and dysenteries in the army, especially the former, though infinitely less fatal than the yellow fever, have been attended with an unusual number of deaths.

P. S. Townsend, M.D.

New-York, September, 1847.]

Bibliog. and Refer.—*H. Warren*, Treatise concerning the Malignant Fever of Barbadoes, 8vo. Lnnd., 1740.—*J. J. de Gastelbondo*, Tratado del Motodo Curat. del Vomito Negro, 12mo. Madr., 1755.—*J. P. Schotte*, A Treatise on the Synochus Atra Biliosa; a Contagious Fever, which raged at Senegal in 1778, &c., 8vo. Lond., 1782.—*J. Mackittrick*, in *Baldinger's* Syllog. Select. Opusc., vol. i., p. 87; et *J. Moultrie*, in Ibid., vol. i., p. 163.—*T. Romay*, Dissertacion sobre la Fièbre Amarilla, 4to. Habana, 1791.—*J. Devèze*, Recherches sur la Maladie Epidémique qui à ravagé Philadelphie en 1793, 8vo. Phil., 1794. (*Non-infectious.*)—*W. Currie*, A Treatise on the Synochus Icteroides, or Yellow Fever, as it lately appeared at Philadelphia, 8vo. Philad., 1794.—*M. Carey*, A short Account of the Malignant Fever lately prevalent in Philadelphia, 8vo. Philad., 1794.—*B. Rush*, Inquiry into the late Epidemic Fever at Philadelphia, 8vo. Phil., 1793; and An Account of the Bilious Remittent Fever as it appeared in the City of Philadelphia in the year 1793, 8vo. Phil., 1794. (*In this and his other works he confounds Bilious, Remittent, and Pestilential Fever with each other, and illogically contends that what is true of the first and second is also true of the third.*)—*J. Cathrall*, A Medical Sketch of the Synochus Maligna, 8vo. Phil., 1794.—*Anderson*, in *Duncan's* Annals of Medicine, &c., vol. v., p. 38; *Drennan*, in Ibid., vol. v., p. 349.—*Paterson*, in Ibid., vol. v., p. 356.—*J. Holliday*, Tratado sobre la Fièbre Amarilla, 8vo. Habana, 1794.—*J. Patterson*, Remarks on the Opinions of Dr. Rush on the Yellow Fever, 8vo. Lond., 1795. (*Infectious.*)—*J. Bryce*, Account of the Yellow Fever, with a successful Method of Cure. Edin., 1796.—*J. Clarke*, A Treatise on the Yellow Fever in Dominica in 1793-6, 8vo. Lond., 1797.—*J. Masdevall*, Relacion de las Epidemias de Calenturas Putridas y Malignas en Catalana, 4to. Madr., 1797.—*S. Anderson*, A Few Facts and Observations on the Yellow Fever, 8vo. Lond., 1798.—*C. F. Ameller*, Descripcion de la Enfermedad Epidemica en Cadiz, 4to. Cadiz, 1800.—*R. Armesto*, Reflexiones sobre la Epidemia en Cadiz, 8vo. Cadiz, 1800.—*W. Fowle*, A Treatise on the different Fevers of the West Indies, 8vo. Lond., 1800.—*C. Chisholm*, An Essay on the Malignant Pestilential Fever introduced into the West Indian Islands from Bulam, in 1793 and 1794, 2 vols., 8vo. Lond., 1793, and 3d edit., 1801.—*P. M. Gonzales*, Disertacion Medica sobre la Calentura que Regno en Cadiz, 8vo. Madr., 1801.—*D. Grant*, An Essay on the Yellow Fever, 8vo. Lond., 1801.—*J. N. Berthé*, Précis Historique de la Maladie dans l'Andalousie, 8vo. Paris, 1802. (*Imported and infectious.*)—*J. Dancer*, Strictures on Dr. Grant's Essay on Yellow Fever, 8vo. Lond., 1802.—*N. P. Gilbert*, Mémmire sur la Fièvre Jaune, 8vo. Paris, 1803.—*R. Bayley*, An Account of the Epidemic Fever in the City of New-York during the Summer and Autumn of 1795, 8vo. New-York, 1796.—*T. Mifflin*, Proofs of the Origin of Yellow Fever in Philadelphia, 8vo, 1797.—Facts and Observ. relating to the Nature and Origin of the Pestilential Fever which prevailed in this City in 1793, 1797, and 1798, by the College of Phys. of Philadelphia, 8vo. Philad., 1798.—*W. Currie*, Memoirs of the Yellow Fever which prevailed in Philadelphia and other parts of the United States in the Summer and Autumn of 1798, with Facts respecting the Origin of the Fever, &c., 8vo. Philad., 1798. (*Imported and infectious.*)—*B. Rush*, Observat. on the Origin of the Malig., Bilious, or Yellow Fever in Philad., &c., 8vo. Philad., 1799; et A Second Address, &c., containing additional Proofs of the Domestic Origin of the Malignant, Bilious, or Yellow Fever, &c., &c., 8vo. Philad., 1799.—*C. Caldwell*, Medical and Physical Memoirs, containing a Particular Inquiry into the Origin and Nature of the Pestilential Epidemics of the United States, 8vo. Philad., 1801.—Address to Philadelphia Medical Society on the Analogies between Yellow Fever and true Plague, 8vo. Philad., 1801.—*J. Hardie*, An Account of the malignant Fever lately prevalent in New-York, 8vo. N. Y., 1799; and Account of the Malig. Fever which prevailed in the City of New-York during the Autumn of 1805. New-York, 1805.—*J. B. Leblond*, Observat. sur la Fièvre Jaune, et sur les Maladies des Tropiques, 8vo. Paris, 1805. (*Infectious.*)—*S. H. Jackson*, Observations, &c., on the Epidemic Disease which lately prevailed at Gibraltar, intended to illustrate the Nature of Contagious Fevers in general, 8vo. Lond., 1806. (*Infectious.*)—*B. Progretto*, Sull' Origine, Natura, e Carattere

della Peste dei Contagie, e della Fièbre Gialla, 8vo. Lucca, 1804. (*Imported and infectious.*)—*Dalmas*, Recherches Historiques et Medicales sur la Fièvre Jaune, 8vo. Paris, 1805. (*Imported and infectious.*)—*Palloni*, Observat. Medicales sur la Fièvre Jaune regnante en Livorne, 8vo. Paris, 1800. (*Infectious.*)—*Puquet*, Mém. sur les Fièvres de Mauvais Caractere, &c., 8vo. Lyons, 1804. (*Infectious and imported.*)—*T. Lafuente*, De la Preservacion, &c., de la Fièbre Amarilla, 8vo. Madr., 1803.—*L. Valentini*, Traité de la Fièvre Jaune, 8vo. Paris, 1803.—*J. M. Arejula*, Succincta Exposicion de la Enfermedad en Malaga, 4to. Mal., 1804; et Breve Descripcion de la Fiébre Amarilla de Cadiz, 8vo. Madr., 1806. (*Introduced and infectious.*)—*W. Batt*, Alenni ditagli sulla Febbre Gialla, 8vo. Genoa, 1804. (*Imported and infectious.*)—*D'Oyarvide*, Delo Vomito Negro, 8vo. Habana, 1801. (*Imported and infectious.*) *S. Henderson*, On the Means of Preventing the Yellow Fever, 8vo. Birm., 1808.—*A. M. T. Saveresy*, De Fièvre Jaune en Général et Particulièrement de celle qui a regné a la Martinique en 1803 et 1804, &c., 8vo. Nap., 1809.—*C. Chisholm*, A Letter to Dr. Haygarth, exhibiting farther Evidence of the Infectious Nature of the fatal Pestilential Fever in Grenada in 1793-1796; and in the United States of America from 1793 to 1805, 8vo. Lond., 1809.—*E. N. Bancroft*, An Essay on the Disease called Yellow Fever, with Observat. on Febrile Contagion, &c., 8vo. Loudon, 1811. (*Non-infectious.*)—*B. Mellado*, Historia de la Epidemia en Cadiz, el Anno de 1810, 8vo. Cad., 1811.—*A. Vilascca*, Noticia acerca dc la Calentura Americana, 8vo. Palma, 1811.—*F. Flores*, Sobray el Tifus Icterodes, 8vo. Cadiz, 1813. (*Infectious and imported.*)—*F. Moreno Flores*, Ensayo sobre et Tifus Icterodes o Fiebre Amarilla, 4to. Cadiz, 1813. (*Infectious and imported.*)—*C. Powell*, A Treatise on the Endemic or Yellow Fever of Tropical Climates, 8vo. Lond., 1814. (*Confounds endemic remittents with this pestilence.*)—*E. Doughty*, Observations and Inquiries on the Yellow or Bulam Fever, 8vo. Lond., 1816.—*A. Mor. de Jonnès*. Précis Historique sur l'Irruption de la Fièvre Jaune à la Martinique en 1801, 1802, 8vo. Paris, 1816. (*Infectious.*)—*E. N. Bancroft*, Sequel to an Essay on Yellow Fever, &c., 8vo. Lond., 1817.—*J. Veitch*, On the Nature and Treatment of the Yellow Fever, 8vo. Lond., 1818.—*V. Bally*, Du Typhus d'Amerique, ou Fièvre Jaune, 8vo. Paris, 1814; et Histoire Medicale de la Fièvre Jaune en Espagne, 4to. Paris, 1821.—*W. Pym*, Observat. on the Bulam Fever which has of late Years prevailed in the West Indies, on the Coast of America, at Gibraltar, Cadiz, &c., with Facts proving it a highly contagious disease, 8vo. Lond., 1815.—*J. Fellowes*, Reports of the Pestilential Disorder of Andalusia, which appeared at Cadiz in the Years 1800, 1804, 1810, and 1813; of that fatal Epidemic which prevailed at Gibraltar in 1804, &c., 8vo. Lond., 1815. (*Infectious.*)—*F. C. Caizergues*, Mémoire sur la Contagion de la Fièvre Jaune, 8vo. Paris, 1817. (*Contagious.*)—*E. Pariset et Mazet*, Observations sur la Fièvre Jaune, faites à Cadiz in 1819, folio. Paris, 1820. (*Cantagious.*)—*G. Burnie*, Practical Remarks on Yellow Fever, 8vo. Belf., 1819.—*N. Dickenson*, Observat. on the Inflammat. Epidemic incidental to Strangers in the West Indies, commonly called Yellow Fever, 8vo. Lond., 1819.—*M. Pariset*, Rap. lu à l'Acad. Roy. de Méd. au nom de la Commission Chargée d'Examiner les Documens de *M. Chervin*, 4to. Paris, 1819. —Report of the Committee of the Medical Society of New-York on the Epidemic Fever which prevailed in Bunckerstreet, in the Summer and Autumn of 1820, 8vo. N. Y., 1828.—*M. Cavaniles*, Memoria sobre la Epidemia de Andalusia de 1800, Hasta, 1819, 4to. Cadiz, 1820.—*M. Hurtado de Mendoza*, Nueva Monografia de la Calentura Amarilla, 4to. Huesca, 1820.—*J. Devèze*, Traité de la Fièvre Jaune, 8vo. Paris, 1820.—*A. de Maria*, Memoria sobre la Epidemia de Andalusia de 1800, Hasta, 1819, 4to. Cadiz, 1820. —*A. Moreau de Jonnès*, Monographie Historique et Médicale de la Fièvre Jaune des Antilles et Recherches sur les Lois du Dèvelopement et de la Propagation de cette Maladie, 8vo. Paris, 1820.—*N. Gerardin*, Mémoires sur la Fièvre Jaune considérée dans sa Rapports avec les Gouvernmens, 8vo. Paris, 1820.—*J. Sedillot*, Notice sur la Fièvre Jaune, la Peste, et le Typhus considérés comme non-contagieux, 8vo. Paris, 1820.—*F. M. Audouard*, Lettre sur la Contagion de la Fièvre Jaune; reponse à *J. Sedillot*, 8vo. Paris, 1820.—*P. F. Keraudren*, De la Fièvre Jaune, Obser. aux Antilles, et sur les Vaisseaux du Roi considérés principalement sous la Rapport de sa Transmission, 8vo. Paris, 1823. (*Contagious.*)—*W. Fergusson*, in Transac. of Med. and Chirurg. Soc. of London, vol. ii., p. 180; vol. viii., p. 108. —*J. D. A. Gilpin*, in Ibid., vol. v., p. 303.—*A. Musgrave*, in Ibid., vol. ix., p. 93.—*J. Fernandez*, Ensayo Analytico sobre la Natur. las Causas, &c., de las Calenturas Amarillas, 4to. Habana, 1821.—*R. Jackson*, Remarks on the Yellow Fever of the South Coast of Spain, since the year 1800, 8vo. Lond., 1821. (*Non-infectious.*)—*T. O'Halloran*, A brief View of the Yellow Fever of Andalusia in 1820, 8vo. Lond., 1821. (*Non-infectious.*)—*J. M. Salamanca*, Observaciones sobre el Contagio de la Fièbre Amarilla, 8vo. Malaga, 1821. (*Imported and infectious.*)—*M. F. M. Audouard*, Relat. Histor. et Médicale de la Fièvre Jaune de Barcelona, 8vo. Paris, 1822. (*Import. and infect.*)—*J. A. Rochoux*, Recherches sur la Fièvre Jaune, 8vo. Paris.—*Larrey*, Consid. sur la Fièvre Jaune, 8vo. Paris, 1822.—*P. S. Townsend*, An Account of the Yellow Fever, as it prevailed in the City of New-York in 1822, 8vo, 1823. (*Imported and infectious.*)—*G. Blane*, in Edin. Med. and Surg. Journ., vol. iii., p. 385.—*Nagle and Wilson*, in Ibid., vol. vii., p. 280.—*Chisholm*, Ibid., vol. ix., p. 412.—*W. Pym*, in Ibid., xi., p. 383; et vol. xii., p. 183.—*Doughty*, in Ibid., vol. xiii., p. 238.—*Gilpin*, in Ibid., vol. x., p. 41.—*Fergusson*, in Ibid., vol. xv., p. 427.—*Smith*, in Ibid., vol. xxxv., p. 12.—*J. Imray*, in Ibid., vol. lxiii., p. 78.—*C. Chisholm*, A Manual of the Climate and Dis. of Tropical Countries, &c., 8vo. Lond., 1822, p. 167.—*J. R. Ferrari*, On the Yellow Fever of Xeres in 1821, in Edin. Med. and Surg. Journ., vol. xix., p. 368. (*Imported and infectious.*)—*Ozanam*, Hist. Med. de Epidemies, t. iv., p. 335.—*E. Bally*, Rapport, &c., sur la F. J. regnant au Port de Passages in 1823, 8vo. Paris, 1824.—*V. Bally*, Rapport, &c., sur la F. J. qui a regné an Port du Passage en 1823, 8vo. Paris, 1824.—*D. Hosack*, Essays on various Subjects of Medical Science, 2 vols., 8vo. New-York, 1824, vol. i., p. 253. (*Imported and infectious.*)—*F. E. Fodéré*, Leçons sur les Epidemies et l'Hygiène Publique, &c., t. iv., p. 228. (*Imported and infectious.*)—*Bally François et Pariset*, Histoiré Médicale de la Fièvre Jaune observée en Espagne et Particulièrement en Catalogue dans l'Année 1821, 8vo. Paris, 1823. (*The French Commission. Most irrefragable proofs of importation and infection.*)—*T. O'Halloran*, Remarks on the Yellow Fever of the South and East Coasts of Spain, 8vo. Lond., 1823. (*Non-infect.*)—*Baldissonc*, Manifesto sulla Febbre di Barcelona dell' Anno 1821, 8vo. Gen., 1824.—*W. Burnett*, Official Report on the Fever of H. M. S. Bann, on the Coast of Africa, 8vo. Lond., 1824. (*Infectious.*)—*C. C. Matthæi*, Untersuchung über das Gelbe Fieber, 8vo. Hannov., 1827.—*J. Wilson*, Memoirs of West Indian Fever, 8vo. Lond., 1827. (*Non-infectious.*)—*A. J. Ralph*, in Transac. of Med. and Chirurg. Society of Edin., vol. ii., p. 49.—*W. W. Fraser*, A Letter to the Earl of Chatham, Governor of Gibraltar, relative to the Feverish Distempers of that Garrison, 8vo. Lond., 1826. (*Imported and infectious.*) —*J. N. E. von Reider*, Abhandlung über das Gelbe Fieber, 8vo. Wien., 1828.—*V. N. ab Hildenbrand*, Institutiones Practico-Medicæ, &c., t. iv., p. 480. (*Infectious; classes this pestilence with the exanthematous fevers.*)—*A. Heastie*, Treatise on the Nature and Causes of the Yellow Fever, 8vo. Lond., 1830.—*J. Hennen*, Sketches of the Med. Topography of the Mediterranean, &c., 8vo. Lond., 1830; of the Gibraltar Epidemics, p. 91.—*Gilkrest*, Cyclop. of Pract. Med., vol. ii.—*J. A. Rochoux*, Recherches sur les Differentes Maladies qu'on appelle Fièvre Jaune, 8vo. Paris, 1828.—*M. D. Emery*, Reflexion sur la Fièvre Jaune, 8vo. Paris, 1828.—*J. C. de Fermon*, Révue Critique de quelques Ecrits Publics sur la Fièvre Jaune, 8vo. Paris, 1829.—*Chervin*, Examen des Nouvelles Opinions de M. Lassis concern. la Fièvre Jaune. Paris, 8vo, 1829; et Examen Critique des Prétendues preuves de Contagion de la F. J. observée en Espagne, &c., 8vo. Paris, 1828. See, also, his various papers reviewed in Edin. Medical and Surg. Journ., vol. xxxv., p. 365. (*This zealous apostle of non-infection confounds remittent fever with this pestilence, and either suppresses or does not admit the established fact of protection causcd by a former attack; hence most of his pleadings are baseless and irrelevant.*)—*Chervin, Louis, et Trousseau*, Documens receuillis par MM. envoyés à Gibraltar pour observer l'Epidemic de 1828, et par *M. Barry*, &c., 8vo, 2 tomes. Paris, 1830.—*J. Boyle*, The Epidemic Yellow Fever in Sierra Leone in 1823 and 1829, in a Pract. Medico-Histor. Account of the Western Coast of Africa, and of the Fevers of Western Africa, &c., 8vo. Lond, 1831. (*Furnishes proofs of the differences between this pestilence and the endemic remittent of the climate; and while the author argues against infection, he actually furnishes proofs against his own doctrine.*)—*D. Barry*, On the Gibraltar Epidemic; in London Med. and Physical Journal, vol. lxv., p. 380 and 476; vol. lxvi., p. 91 and 475; vol. lvii., p. 1-96 —*P. Wilson*, On Gibraltar Epidemic, Lancet, June, 1830, p. 425.—*M. Guyon*, On the Origin of the Gibraltar Epidemic, Journ. complem. des Sc. Med., Sept., 1830; and Lond. Med. and Phys. Journ., vol. lvi., p. 286. (*Imported and infectious.*)—*H. Fraser*, in Ibid., vol. lvi., p. 213, 314; and *Johnson's* Med. and Chirurg. Review, Sept., 1830.—*M. E. A. Naumann*, Handbuch der Medicinischen Klinik, b. iii. Abth. i., p. 321. (*Classes this pestilence, the plague, choleric pestilence, and exanthematic typhus as species of the genus—contagious typhus.*)—*P. C. A. Louis*, Anatomical, Pathological, and Therapeutic Researches on the Yellow Fever of Gibraltar, &c., transl. by *G. C. Shattuck*, 8vo. Boston, 1839.—Report of a Special Committee of the House of Assembly of the State of New-York on the present Quarantine Laws, 8vo. Albany, 1846. This able report, kindly forwarded by Dr. P. S. TOWNSEND, of New-York, reached me as this was passing through the press. It contains the evidence of the most eminent physicians in that city, and numerous facts fully confirming the views entertained in the preceding article. It is most satisfactory to have so

important and convincing a body of evidence as this report contains, so opportunely furnished, although too late to aid in my labours.

[Am. Bib. and Refer.—*P. S. Townsend*, Account of the Introduction of the Yellow Fever into Pensacola and New-Orleans in 1822, New-York Med. and Phys. Jour., vol. ii., p. 315; et An Account of the Yellow Fever as it prevailed in the City of New-York in the Summer and Autumn of 1822, 8vo, p. 383.—A History of the Proceedings of the Board of Health of the City of New-York in the Summer and Fall of 1822, &c. New-York, 1823, p. 270.—*James Speed*, On Yellow Fever of North America, in Med. Repository, vol. ix., p. 259.—*William Baker*, On the Origin and Cause of Yellow Fever, and Means of Prevention, in Med. Repository, vol. ix., p. 268.—*J. Comstock*, On Bilious or Yellow Fever, in New-York Med. Rep., vol. x., p. 21.—*H. Hill*, On Yellow Fever in Havana, Med. Rep., vol. x., p. 113.—*Chatard*, On Yellow Fever in Baltimore in 1800, Med. Repository, vol. iv., p. 253.—*Selden* and *Whitehead*, On the Yellow Fever of Norfolk, Va., 1800, Med. Rep., vol. iv., p. 329.—*Daniel Moore*, On Yellow Fever of Baltimore, 1800, in Med. Rep., vol. iv., p. 351.—*Charles Caldwell*, An Address to the Phil. Med. Society, on the Analogies between Yellow Fever and true Plague, in Med. Rep., vol. iv., p. 400; vol. i., N. S., p. 143.—*M. M'Dowell*, in Med. Repos., vol. ix., p. 366.—*J. G. Scott*, Examples of the Origin of Yellow and Uncontagious Fevers in various parts of the State of New York, Med. Repository, vol. x., p. 240. —*N. Webster*, Address to the Citizens of the United States on the Malignant Fevers of their Country, N. S. Med. Repository, vol. i., p. 316.—*R. M. Collins*, A Dissertation on the Remote Cause of Fever, Transylvania Jour. of Med. for 1828, p. 485.—*Alex. Hosack, Jr.*, An Inaugural Essay on Yellow Fever of 1795 in New-York. New-York, 1797, 8vo, p. 40.—*Valentine Seaman*, On Yellow Fever in New-York, New-York Med. Repository, vol. ix., p. 391; vol. i., p. 303; et vol. iv., p. 248.—*B. Ticknor*, An Account of the Yellow Fever which prevailed at Thompson's Island, North Am. Med. and Surgical Journal, Nos. VI. and VII., 1827.—*Charles Coffin*, An Account of the Pestilential Fever which prevailed in Newburyport, State of Mass., 1796, Med. Repository, vol. i., p. 493.—*Joseph Browne*, Treatise on the Yellow Fever. New-York, 8vo, p. 31, 1798.—*Mifflin's* Letters on Yellow Fever, Med. Rep., vol. i., p. 391, 398.—*John B. Davidge*, A Treatise on the Yellow Fever. Balt., 8vo, p. 65, 1798.—Phil. Acad. of Med., On Origin of Yellow Fever of 1797. Phil., 8vo, p. 49, 1798.—*A. J. De Rosset*, Account of Pestilential Fever of Wilmington, 1796, Med. Repository, vol. xi., p. 143.—*W. Currie*, Memoirs of Yellow Fever which appeared in Philadelphia and other parts of the United States in 1793. Philadelphia, 8vo, p. 145.—*P. S. Physic*, Letter on Yellow Fever, Med. Repository, vol. xi., p. 327.—*Ed. Miller*, On Yellow Fever, Med. Rep., vol. xi., p. 379.—*Isaac Rand*, On Yellow Fever in Boston, Med. Repository, vol. xi., p. 442.—*Samuel Brown*, A Treatise on Yellow Fever. Boston, 8vo, p. 42, 1800.—*W. Harris*, Fever, with Black Vomit, in the middle part of Penn., Med. Rep., vol. iv., p. 75.—*L. Hallock*, An Account of a Malignant Disease which appeared on board of the United States Frigate Gen. Greene, Med. Repository, vol. iv., p. 1. —*E. T. Waring*, Account of Same, Med. Repos., vol. iv., p. 234.—*David Ramsay*, Facts concerning Yellow Fever in Charleston, S. C., Med. Repository, vol. iv., p. 217; vol. xi., p. 233.—*John Vaughan*, in Med. Repository, vol. iv., p. 233. —*Joseph Bayley*, Facts and Observations relating to the Yellow Fever which prevailed at the Quarantine Establishment at Staten Island, New-York, during the Autumn of 1821, New-York Med. and Phys. Journ., vol. i., p. 12.—Report on the Yellow Fever which prevailed in New-York in 1822, New-York Med. and Phys. Journ., vol. i., p. 422. —*Daniel D. Walters*, Diary of the Occurrences of the first Month of the Yellow Fever which prevailed in the City of New-York in 1822, with Facts and Observations relative to the Nature and Character of the Disease, New-York Med. and Phys. Journ., vol. i., p. 469.—*John B. Beck*, A Report to the New-York Board of Health concerning the Nature and Origin of the Malignant Fever in Middletown, Conn., 1820, New-York Med. and Phys. Journ., vol. i., p. 158.—Fevers: their Diagnosis, Pathology, and Treatment; Prepared and Edited, with large Additions from the Essays on Fever in *Tweedie's* Library of Practical Medicine, by *Meredith Clymer*, M.D., &c. Phil., 1846, 8vo, p. 605.—*George B. Wood*, A Treatise on the Practice of Medicine, in 2 vols., 8vo, p. 793.—*Robley Dunglison*, The Practice of Medicine, a Treatise on Special Pathology and Therapeutics, 2d Ed. Philad., 2 vols., 8vo, 1844.—*Samuel Henry Dickson*, Essays on Pathology and Therapeutics, &c., in 2 vols., 8vo. Charleston, S. C., 1845.—*John W. Monette*, Observations on the Yellow Fever of Natchez and of the Southwest. Louisville, Ky., 8vo, p. 155; et Western Med. and Phys. Journal, 1825.—*S. Barrington*, Account of Yellow Fever as it appeared on board the United States sloop-of-war Hornet in 1828, United States schooner Grampus in 1829, and United States sloop-of-war Peacock in 1830, Am. Journal Med. Sci., vol. xii., p. 307.—*E. B. Harris*, On Yellow Fever at New-Orleans in 1833, in Am. Jour. Med. Sci., vol. xiv., p. 41.—*E. H. Barton*, Account of Yellow Fever at New Orleans in 1833, in Am. Journ. Med. Sci., vol. xv., p. 30.—*John Harrison*, On Cadaveric Lesions in Yellow Fever, in New-Orleans Med. and Surgical Journal, 1845–6.—*C. C. Dupré*, On the Yellow Fever at Key West, East Florida, in Am. Journal Med. Sci., vol. ii., N. S., p. 380.—*Thomas Stewardson*, in Amer. Journal Med. Sci., vol. iii., p. 91.—*Richard D. Arnold*, Two Cases of Black Vomit, with Observations, in Am. Journ. Med. Sci., vol. iv., p. 316. (Dr. A. makes the peculiar distinctive characteristic of Yellow Fever to be a total absence of biliary secretion and excretion.)—Account of Yellow Fever in Charleston, 1838, Am. Journal Med. Sci., vol. xxiii., p. 263.—*Thomas Y. Simons*, A Report on the History and Causes of the Stranger's or Yellow Fever of Charleston. Charleston, 8vo, p. 23.—*Robertson*, *Garvin*, and *Eve*, Report on Yellow Fever in Augusta, 1839, 8vo, p. 30.—*Ashbel Smith*, An Account of the Yellow Fever at Galveston in 1839, with Cases, &c., 12mo, p. 78. Galveston, 1839.—*B. B. Strobel*, An Essay on the Subject of Yellow Fever, intended to prove its transmissibility. Charleston, 1840, 8vo, p. 224.—*John D. Gillespie*, Report on Yellow Fever at Brooklyn in 1809, in Am. Med. and Phil. Register, vol. i., p. 106.—*William Currie*, Facts and Arguments in favour of the foreign Origin and contagious Nature of the Pestilential or Malignant Yellow Fever, in a Letter to Dr. *Hosack*, in Am. Med. and Phil. Register, vol. i., p. 181.—*John R. B. Rodgers*, Account of Yellow Fever in Brooklyn in 1809, in New-York Med. and Phil. Jour. and Rev., et New-York Med. and Phil. Reg., vol. i., p. 253.—*Richard Channing Moore*, Facts relative to the contagious Nature of Yellow Fever in Brooklyn in 1809, in New-York Med. and Phil. Reg., vol. xi., p. 22.—*D. Hosack*, Review of *Ed. Miller* on Yellow Fever in Brooklyn in 1809, in New-York Med. and Phil. Reg., vol. ii., p. 91–164, 270.—History of the Yellow Fever at Perth Amboy in 1811, Am. Med. and Phil. Reg., vol. iii., p. 102. (Drawn up by Drs. *Hosack*, *Bayley*, and *Douglass.*)—*John Stewart*, An Account of Yellow Fever at Granada, West Indies, in 1793–4–5, in Am. Med. and Phil. Reg., vol. iii., p. 183.—*D. Hosack*, On the Yellow Fever of Huntington, L. I., in Am. Med. and Phil. Reg., vol. iii., p. 191.—*John M'Knight*, On Yellow Fever of New-York of 1798, in Am. Med. and Phil. Reg., vol. iii., p. 293.—*James Seagrove*, On Yellow Fever of St. Mary's, Georgia, 1808, in Am. Med. and Phil. Reg., vol. iii., p. 417.—*John Mitchill*, An Account of the Yellow Fever in Virginia in 1737, 1741, 1742, in Amer. Med. and Phil. Reg., vol. iv., p. 181, 383.—*P. Bowen*, Account of Yellow Fever in Providence, R. I., 1805, in Am. Med. and Phil. Reg., vol. iv., p. 331, 341.—*C. Calden*, On Yellow Fever of Virginia, in Amer. Med. and Phil. Reg., vol. iv., p. 378.—*J. C. Warrin*, On Yellow Fever in Boston, in Amer. Med. and Phil. Reg., vol. iv., p. 557.—*B. Dowler*, Researches, Historical, Topographical, and Critical, on Yellow Fever, New-Orleans Med. and Surg. Jour., vol. iii., p. 165. —*E. D. Fenner*, Account of Yellow Fever in New-Orleans in 1846, New-Orleans Med. and Surg. Journal, vol. iii., p. 445.—*W. P. Hort*, Report of Board of Health of New-Orleans for 1846, New-Orleans Med. and Surg. Jour., vol. iii., p. 467.—*John W. Francis*, Report of a Special Committee of the House of Assembly of the State of New-York on the Quarantine Laws, 1846, p. 148.—*A. V. Vache*, in *Ibid.*, p. 68.—*T. Harris*, in *Ibid.*, p. 111.—*P. S. Townsend*, in *Ibid.*, p. 115.—*W. Sweetser*, in *Ibid.*, p. 153.—*J. R. Manley*, i., *Ibid.*, p. 163.—*Hort*, in *Ibid.*, p. 167.—*D. M. Reese*, in *Ibid.*, p. 211.—*W. S. W. Ruschenberger*, in *Ibid.*, p. 215.—*W. C. Wallace*, in *Ibid.*, p. 207.—See, also, Bost. Med. and Surg. Journal, *passim*.—*W. P. Dewees*, Practice of Medicine.—*Hosack*, Lectures, and Ed. of *Thomas's* Practice, &c.]

PESTILENCE, SEPTIC.—Synon. *Pestilentia Scptica*, Author. *Pestis* (from pasco, pastum, quod depascatur artus; *or from* pessum, quod pessum det). *Pestis Septica*, *Pestis glandulosa*, *P. Adeno scptica* (from Σηπω, putrefacio; Σηπτὸς, σηπτικὸς, septic, putrid, liquescent, &c.), Λοιμος, Hipp., Galen. Λοιμώδης πυρετος, Auct. Græc. Λοιμὸς σηπτικὸς. *Pestilentia*, Celsus, Pliny, Cicero. *Pestis*, Auct. Var. *Pestis Oricntalis*, Auct. *Typhus Pestilentialis*, *T. Gravissimus*, *T. Anthracicus*, *T. Bubonicus*, *Febris Pestilentialis*, *&c.*, Auct. Var. *Typhus Pestis*, Young *Anthracia Pestis*, Good. *Exanthema Pestis*, Parr. *Loimopyra*, Swediaur. *Pestis Acutissima*, *P. Inquinaria*, *Pestilitas*, *Ephemcra Pestilentialis*, *E. Mortifcra*, *Febris Adeno-Nervosa*, Pinel. *Peste*, *Pestilence*, *Fievre pestilentielle*, Fr. *Pest*, *Plage*, *Pestfieber*, *Pestilenz*, Germ. *Pest*, *Pestilents*, Dan. Swed. *Peste*, *Pestilenza*, Ital. *Plague*, *Pest*, *Pesti-*

lence, Levant Plague, Septic or Glandular Pestilence, &c

Classif.—Same as Choleric and Hæmagastric Pestilences.

1. Defin.—i. Nosological.—*After chills, rigours, or horrors, nausea and vomiting, with vertigo, headache, or stupefaction, and fever; sense of heat or burning at the præcordia; rapid, weak, irregular, or intermitting pulse; and carbuncles, buboes, spots, pustules, or petechiæ of various colours distributed in different parts of the body.*

2. ii. Pathological.—*An animal poison or miasm specifically affecting the nervous and vascular systems, the circulating fluids, vessels, and glands, and remarkably impairing, and very frequently entirely subverting, vital resistance and the cohesion of the tissues.*

3. Annihilation of vital resistance and of the cohesion of the tissues characterizes more or less all severe cases of pestilence, and all malignant febrile diseases. The causes which occasion them—specific animal poisons—exert a manifest septic influence; manifest, at least, in their results, however the powers of life, in their resistance to the noxious causes which have invaded them, may give rise to various modes of reaction, or attempts at reaction, and ultimately either throw off the destructive agencies, or sink beneath them. But the virulence of the poison occasioning the plague, and the septic or life-dissolving influence it exerts, as evinced by the spots, by the carbuncles, by the sphacelations of portions of the cutaneous, adipose, and cellular tissues, by the softening of the internal viscera, and by the diffluent or softened state of the lymphatic glands and surrounding structures found immediately after death, are so remarkable, especially where this pestilence is epidemic, that I have thought that these malignant properties, as being the most characteristic and the most generally present, should furnish the specific designation of the distemper. I have, therefore, used the word *septic* in the sense usually attached to it, to mark this tendency to vital dissolution and its actual consequences in this pestilence, as being, perhaps, the most appropriate, as marking the chief disposition and pathological conditions—the remarkable malignancy of the fully-developed distemper. It may not be approved by many, as not indicating the states of nervous power and vascular action characterizing the attempts made by the nervous and vascular systems under the influence of life, to resist the exterminating influence of the poison which has infected them; and I cannot say that it quite pleases myself; but I am anxious to avoid, on this occasion, as I have hitherto avoided, the introduction of new and foreign terms into this work. I shall, however, adopt any one that is unquestionably better, if the objectors will furnish it; but the topic will be discussed more fully hereafter.

4. There can he no doubt of this pestilence having appeared at various epochs as remote as history has furnished the records, in several countries bordering on the Mediterranean, and especially in Egypt. The sacred books of the Old Testament, and the writings of Hippocrates, Aretæus, and Galen, furnish notices of pestilences, which may be considered as more applicable to this than to any other species. Still they give no description sufficient to enable us to decide positively as to their identity with that now under consideration. The earliest notice strictly applicable to this distemper to be found in the writings of the ancients is that by Rufus, preserved in an inedited book of Oribasius, and to which reference is made by M. Littre, in his edition of *Hippocrates*, and in his article on the plague in the *Dictionnaire de Medicine*. Rufus describes buboes as appearing in the neck, armpits, and thighs, and as being either with or without fever. But the buboes called *pestilential*, he states, are the most acute and the most dangerous. Such as are seen especially in Libya, Egypt, and Syria; and of which Denys, surnamed Kyrtus, has made mention. Dioscorides and Posidonius, he adds, have concerned themselves chiefly with the pestilence which prevailed in Libya. They state that in this plague there were acute fever, pain, and tension of the whole body, delirium, and the formation of buboes, which were hard and large, and which did not go on to suppuration. These buboes appeared not only in the usual places, but also in the hams and bends of the arms. (*Classicor. Auct. e Vaticanis Codicibus Edit.* curante A. Maio, 8vo. Romæ, 1831, t. iv., p. 11.)

5. No farther account need be taken of the brief notices of plague which are scattered through the works of the ancients, until we come to the description of the fatal epidemic by Procopius that depopulated the Roman empire in the reign of Justinian. An abstract of these notices will be found in Mr. Adams's translation of Paulus Æginета (vol. i., p. 279). The pestilence which prevailed in the reign of Justinian is also described by Evagrius and Agathias. It resembles the plague of Avignon, described by Guy de Chauliac. According to Procopius, the usual precursors of an attack were disturbed dreams and various delirious fantasies; but the early symptoms were not well marked; for there was neither increased heat nor discoloration of the skin, nor did the patient apprehend danger. Generally on the first or second day, but in a few instances somewhat later, buboes appeared not only in the groins, but also in the armpits and below the ears. Some were affected with deep coma, and others with wild delirium. Some died from sphacelus of the buboes, which, when inspected by the physicians after death, presented the appearance of an anthrax, or carbuncle. Some died at the commencement, and others after the lapse of several days. In certain cases the skin was covered with black phlyctenæ, of the size of a lentil, which were usually succeeded by sudden death. Others were unexpectedly cut off by a discharge of blood. To women in the puerperal state it proved particularly fatal. When the buboes came to a proper suppuration, they generally proved a favourable crisis; but when they did not suppurate, they were commonly followed by a wasting of the thigh. One of the consequences of the distemper was an affection of the organs of speech. All the usual prognostics proved fallacious; and the effects of the common remedies were uncertain. In some cases the bath proved beneficial, and in others it had a contrary effect. The amount of deaths in Constantinople, at one time, was said, but probably with great exaggeration, to have

ranged from five to ten thousand each day. (*De Bello Pers*, 22, 23, and Adams's *Comment. on* Paulus Æginета, vol. i., p. 281.) This plague appears to have very closely resembled the plague of London in 1665, as described by Dr. Hodges. My limits will not permit any notice of the descriptions of the septic or glandular pestilence contained in the writings of the Arabian physicians. The reader, however, will find a brief abstract of these descriptions, and of the treatment recommended by these writers, in the volume by Mr. Adams just referred to.

6. This pestilence has presented various grades of severity, malignancy, and prevalence, according to the several accounts which have been furnished by contemporary historians and physicians, since the days of Avicenna and other Arabian writers; and even within our own memories, since the commencement of the present century, it has evinced different degrees of severity and prevalence, according as it has appeared in a sporadic or endemic, or in an epidemic form. In the countries of the Levant, and particularly in Egypt, the distemper occurs sporadically or endemically, or rather appears in isolated cases, without becoming epidemic, unless after periods or epochs of indefinite but of considerable duration. In more northerly climates it has occurred only as a destructive epidemic, and then often without any manifest dependence upon season, time of the year, or weather, although a temperate or warm season has appeared to favour its malignancy and prevalence. During the Middle Ages numerous epidemical visitations of this pestilence occurred in Europe, Africa, and Asia, not merely in the countries surrounding the Mediterranean, but also in others more or less remote from this sea. The most destructive outbreak, however, of this pestilence upon record is that which occurred near the middle of the fourteenth century.

7. This pestilence, usually denominated the *black death* or *black plague*, first appeared in China in 1333, when it was said to have destroyed more than one fourth of the population; and it thence proceeded gradually to the western countries of Asia, to those surrounding the Caspian Sea; to Arabia, Syria, and Egypt; and to the eastern and southern kingdoms of Europe. It reached Avignon in 1348, gradually extending northward to France, Germany, England, Denmark, Russia, &c. It invaded Russia in 1350; and there, as well as in other northern countries, it proved nearly as destructive as in southern climates. It appeared first in the southern counties of England, and gradually proceeded northward; and in this, as well as in other countries, was most remarkably destructive in the large, close, and crowded cities and towns. It did not altogether cease in some places, or it continued to recur after intervals, until 1360 or 1361, when it seems to have entirely disappeared. Dr. Hecker has collected from numerous sources much information concerning this pestilence. He states that it was an Oriental plague, marked by boils and tumours of the glands, such as break out in no other febrile disease. From these boils or buboes, and from the black spots and carbuncles indicatory of a putrid decomposition which appeared in the surface, it was called, in the northern countries of Europe, the black death; and in Italy and other southern countries, the great mortality, or great plague.

8. According to Guy de Chauliac, the victims of this plague were frequently attacked with an ardent fever attended by discharges of blood, which proved fatal in three days. Buboes and boils did not come out at first, but a carbuncular affection of the lungs often occasioned the destruction of life before the external symptoms were developed. He adds, that "the plague thus raged in Avignon for six or eight weeks, and the pestilential breath of the sick, who expectorated blood, caused a terrible contagion far and near; for even the vicinity of those who were affected was certain death; so that parents abandoned their infected children, and all the ties of kindred were dissolved. After this period, buboes in the axilla and in the groin, and boils over the body, made their appearance; but it was not until seven months afterward that some patients recovered with buboes, as in the ordinary milder form of plague." (*Tract.*, ii., c. 5, p. 113.) This pestilence appeared in a similar manner in Egypt, destroying quickly with burning heat and expectoration of blood.

9. Boccaccio makes no mention of the first appearance of this pestilence in China, and of its progress westward, but remarks that "this most terrible plague happened in Florence in 1348; that it had broken out some years before in the Levant, and that after passing from place to place, and making incredible havoc all the way, it had now reached the west." It began to show itself in the spring of the year, "in a sad and wonderful manner; and different from what it had been in the east, where bleeding at the nose was the fatal prognostic; here there appeared certain tumours in the groin or in the armpits, some as big as a small apple, others as an egg; and afterward purple spots in most parts of the body; in some cases large and but few in number, in others less and more numerous; both sorts the usual messengers of death." (*Decameron*, Giorn. i., *Introd.*)

10. The same phenomena were remarked in this pestilence as it occurred in Germany, France, Norway, and Russia, and the most prominent among these were the infallible signs of the Oriental or glandular plague. But in different countries certain symptoms appeared more prominently than others, or perhaps were more particularly noted by contemporary or subsequent chroniclers. In France many were struck as if by lightning, and died on the spot, and this more frequently among the young and strong than the old; and the patients with buboes scarcely survived two or three days. In England the distemper was attended, as at Avignon, with spitting of blood, buboes, and carbuncles. In Norway and Poland spitting and vomiting of blood are stated to have occurred in addition to the characteristic signs. In Russia the distemper was said to have commenced with rigours, heat, and darting pains, to have been attended by spitting of blood, and to have terminated fatally in two, or, at most, three days. It was chiefly when the spitting of blood had continued for some time that buboes and carbuncles appeared.

11. Dr. Hecker remarks, that all the descriptions of this most remarkable pestilence

which have come down to us contain, with a few important exceptions, all the symptoms of the true plague as observed in modern times. No doubt can obtain on this point. The facts are placed clearly before our eyes. We must, however, bear in mind that this distemper does not always appear in the same form; and that while the essence of the poison which it produces, and which is separated so abundantly from the body of the patient, remains unchanged, it is proteiform in its varieties, from the almost imperceptible vesicle, unaccompanied by fever, which exists for some time before it extends its poison inwardly, and then excites fever and buboes, to the fatal form, in which carbuncular or gangrenous inflammations affect the most important viscera, as appeared to have been the case in a large proportion of cases of this pestilence.

12. The hæmorrhages which were so frequently remarked, in various countries where this pestilence prevailed, and soon occasioned death, were obviously the result of the vital dissolution of the structures and of the crasis of the blood; the inflammations said to have existed being a state of asthenic vascular congestion with sanguineous exudations, or inflammation of a gangrenous nature, owing to the rapid loss of the vital power of the capillaries. That such was the case in a remarkable degree, as respected the capillaries, the tissues, and the blood itself, was evinced hy the rapid discoloration, the purplish hue, and the loss of sensibility of the affected parts. There was a loss of vital cohesion throughout the whole frame, those tissues and structures, as the mucous, the cellular, the glandular, and the parenchymatous, that possess the least density, and the capillaries supplying them, most rapidly and most completely undergoing this septic alteration.

13. The plague, which devastated the Empire of Morocco in 1799 and 1800, appears to have been equally virulent with the above, but much more circumscribed in its spread. Mr. Jackson, who resided in that country during its continuance, has described it as it came under his own observation. He states that Terodant, the metropolis of a province, lost above eight hundred each day during the height of the pestilence; the city of Morocco lost upward of one thousand daily; and that old and new Fez, about fifteen hundred daily. Young, healthy, and robust persons were for the most part attacked first, then women and children, and lastly thin, sickly, emaciated, and old people. The *symptoms* of this plague varied in different persons with age, constitution, and habit of body. "It attacked some with a sudden and violent shivering, others with a sudden delirium, succeeded by unquenchable thirst. Cold water was eagerly resorted to hy the unwary, and proved fatal to those who indulged in its momentary relief. Some had one, two, or more buboes, which formed and became as large as a walnut in the course of a day; others had a similar number of carbuncles; others had both buboes and carbuncles, which generally appeared in the groin, under the arm, or near the breast. Those who were affected with shivering, having no buho, carbuncle, spots, or any other external disfiguration, were invariably carried off in less than twenty-four hours, and *the body became quickly putrified*, so that it was indispensably necessary to bury it a few hours after dissolution."* (P. 273.)

14. The plague of London in 1665, or the Great Plague, of which, according to Dr. Hodges, upward of 100,000 persons died, presented the phenomena already noticed variously grouped. This writer remarks that this pestilence puts on various or even different appearances, according to the constitution and age of the patient, the season of the year, the modes of living, the preceding and present distempers, and the virulence or degree of infection. Dr. Hodges practiced in London during the continuance of this plague; and, notwithstanding the admixture of the prevailing pathological notions of the day with his description of the symptoms, has given a very instructive account of them. He *first* states "*the manifest signs of infection*," and afterward describes "*the appearances after infection.*" The manifest signs of infection he states to be horror, vomiting, dizziness, delirium, headache, and stupefaction. The appearances after infection are fever, watching, palpitation of the heart, bleeding at the nose, and great heat above the præcordia, all which may occur in other pestilences, but in this they are conjoined with *those which are peculiar to it*, as pustules, commonly called blains, buboes, carbuncles, spots, marks, or tokens. (*Loimologia*, p. 86, *et seq.*)

15. Septic pestilence, which had become much less prevalent for several generations after the black plague of the fourteenth cen-

* The following brief notices of cases will illustrate the characters and nature of the pestilence: 1. M. A. fell suddenly down in the street, and was conveyed home. Three carbuncles and five buboes appeared the same day, in the groin, under the joint of the knee, in the armpits, and inside of the elbow, and he died three hours afterward.

2. L. R. was suddenly smitten when following his avocations, and fell down. He described a sensation similar to that produced by running needles into the parts; and in the situations where this was felt carbuncles afterward appeared. He died the same day.

3. Mr. Jackson's cook appeared in good health and spirits; but in half an hour afterward he came to the room door with his eyes starting from his head, and his bedclothes in his hands, saying, "Open the gate for me, for I am smitten." The next morning he came to the gate half dressed, saying that he was quite recovered. He was not admitted; and accordingly returned to his apartments, and expired the same evening, about twenty-four hours after his seizure; and before daybreak his body was in such a deplorable state that his feet were quite putrefied. His wife was afterward seized, but recovered.

4. H. ben A. was smitten suddenly, and felt at the time as if two musket-balls had passed through his groins. A giddiness and delirium followed, and immediately afterward a green vomiting, and he fell senseless to the ground. A short time subsequently, buboes formed in the places where he felt as if shot; and, on suppurating, discharged a fetid black pus. A carbuncle in the bend of the arm was full of a thin ichor contained in an elevated vesicle, and surrounded by a burning red areola. He ultimately recovered.

Mr. Jackson remarks, that those who had vomitings of green or yellow bile, generally recovered after suffering in various degrees; but that those who were affected with giddiness or delirium, followed by vomiting of black bile, invariably died after lingering one, two, or three days, their bodies being covered with small black spots similar to grains of gunpowder. In this state, however, they possessed their intellects until their dissolution. He adds, that when the constitution was unable to throw the poison to the surface in the form of buboes, carbuncles, boils, or blackish spots, "the virulence seemed to have acted inwardly, or on vital parts, and the patient usually died in less than twenty-four hours;" and that, when the carbuncles or buboes had a blackish circle round their basis, the case was invariably fatal. "Sometimes the whole body was covered with black spots like partridge-shot. Such patients always fell victims; and those who felt the blow internally did not survive more than a few hours." (P. 238, 4.)

tury, again devastated many countries in the sixteenth century, as shown in the writings of Langius, Valleriola, Schenck, Joubert, Palmarius, Ingrassias, and others. In the following century, also, it prevailed in various countries of Western Europe; and, although limited chiefly to large and commercial cities, it was most destructive in those places; as fully shown by the writings of Diemerbroeck, Hodges, De Foe, and many others. During the last century this plague became even more generally epidemic than in the 17th, and invaded most of the countries of Europe, some of them far remote from those to which it was commonly confined. Of these pestilences, full details are to be found in the works of Chenot, Schraud, De Mærtens, Minderer, Samoilowicz, Russel, and others.

16. I. Symptoms.—There are few distempers in which the symptoms are so diversified as in the pestilence now being considered. The severity of the attack, resulting from the intensity of the cause, or dose of the poison, relatively to the susceptibility of the patient; the age, habit of body, and temperament of the person attacked; the severity or character of the prevailing epidemic; and the various circumstances influencing the patient at the time of seizure or during the continuance of the malady, tend to modify the phenomena in a more or less remarkable manner. Diemerbroeck has given a very succinct view of the symptoms of this pestilence, and of the diversities they present, and which I shall here exhibit with but little alteration. Fever, jactitation, extreme anxiety, frequently a remarkable internal heat, dull or gravative pains in the head, rarely acute; terror, horror, or delirium, convulsive startings of the tendons, or slight contractions of the limbs; in some continual watchfulness, in others an overwhelming somnolency; a restless expression of countenance, noises in the ears, and in some deafness; a dry, but rarely a black tongue; great fetor of the breath and of the perspiration; leipothymia or syncope; the pulse sometimes almost natural or full, but most frequently rapid, feeble, unequal, or even intermittent, in many very small, rapid, equal, or irregular; a short or dry cough, sometimes hæmoptysis; thirst, loss of appetite, pain at the epigastrium and cardiac orifice of the stomach, nausea, vomitings, hiccough; crude alvine evacuations, remarkably offensive, sometimes containing worms; occasionally an exhausting diarrhœa; the urine often almost natural, and depositing a settlement, in many high-coloured and scanty, in others crude and turbid, in some sanguineolent, and generally very different in the course of the distemper, or even in the course of the day; sudden prostration of strength, and incapability of motion from the commencement in some, in others but little impairment of power until the moment of dissolution; the heat of skin sometimes acrid and increased, sometimes natural or even reduced; the colour of the countenance either pale or reddened, or somewhat livid, or even natural; purple, violet-coloured, black, or red spots on different parts of the body, sometimes in small numbers, in others in great numbers, and either large or small, but always round, occasionally seen chiefly in certain parts of the body, but confined to no one part in particular, and often scattered over the whole surface; tumours or buboes in the groins, armpits, neck, &c.; carbuncles in different parts of the body, &c. These symptoms are generally not all present in one case; but many of them occur in one, and the rest in others. During the epidemic prevalence of plague in various countries, the symptoms have presented several grades or states, most probably owing to the causes just assigned. These grades or states have been described by several writers of the last century, and their descriptions have been confirmed by those of the present day. I shall first notice these grades, and afterward the several stages into which the progress of the distemper may be divided.

17. i. Grades or States.—Chicoyneau, Verug, Soulier, and others have noticed five grades or states of this pestilence, and which they have described nearly as follows: *First Grade.*—This, the most *intense form* of plague, is observed chiefly at the commencement and during the early course of an epidemic, and consists of all those cases in which the symptoms are most severe, and are most promptly followed by death. The patient is attacked by irregular chills or rigours, or a feeling of general cold, a very small, soft, slow, or frequent, unequal or irregular pulse; by a heavy pain in the head, with a stunning, vertiginous feeling; and by a stupid, muddled, or drunken appearance. The countenance seems fixed, or vacant and apathetic, or presents a look of alarm or despair. The speech is slow, hesitating, plaintive, or interrupted; the tongue is white, and afterward dry, red, black, and rough; the face is pale, or of a leaden hue, or cadaverous; the contractions of the heart are very frequent; the spirits are remarkably depressed; faintness or syncope, vomitings, retchings, great restlessness, distressing anxiety, &c., are frequent, and terminate existence. Persons thus attacked often sink in the course of a few hours, sometimes almost suddenly, or in the course of a night; frequently within twenty-four hours; and seldom survive longer than thirty-six or forty-eight hours; the powers of life sinking lower and lower, without being able to make any resistance. Frequently tremours, or slight convulsive movements, occur at intervals; but none of the external signs, tumours, or eruptions, characteristic of the pestilence appear, the powers of life being insufficient to throw them out on the surface.

18. *B. Second Grade.*—This grade generally commences, as the foregoing, with chills or rigors, and with a similar affection of the head; but these symptoms are followed by some evidence of vascular reaction. The pulse becomes frequent, open, quick, expansive, but remarkably soft and compressible. The patient complains of burning heat internally, while the external temperature is either natural or but little augmented. Thirst is unquenchable; the tongue is white, or reddish brown, or dusky red; speech is hurried, or impetuous, or stammering; the eyes are suffused, fixed, or wild, and bright; the countenance is reddish or slightly livid; respiration is frequent, laboured, or large and slow, but without cough or pain; nausea is common, with vomitings of bilious, greenish, black, or bloody matters, similar matters being passed by the bowels, without ten-

sion or pain the urine is sometimes natural, sometimes turbid, or pale, at other times black or sanguineolent; and the perspirations are offensive, and instead of relieving, merely enfeeble the patient. In some cases hæmorrhages from mucous canals take place, and produce fatal depression. Wandering or phrenitic delirium is common; and when the patient is rational, there are great depression and apprehension of immediate dissolution; nothing tending to rally his spirits, or to re-assure his confidence. In this grade the characteristic signs always appear from the commencement, or in the course of the distemper. Painful tumours or buboes occur in the groins or a little below them, in the armpits, or beneath the ears or lower maxilla, or neck; as well as carbuncles chiefly in the arms and thighs, but sometimes also in other parts; and frequently pustules of a whitish, pale, or livid, black, and carbuncular appearance, or purple spots spread over the surface of the body. Recovery rarely takes place from this state of the pestilence, although death does not occur so quickly as in the foregoing. Nearly all those attacked seem to be carried off by a rapid sphacelation of the parts chiefly affected, extending even to the thoracic and abdominal viscera. It is singular that this form of the disease is met with principally in the fat, robust, and plethoric; and the more these conditions are remarkable, the less is the chance of recovery.

19. *C. The third form* or class of cases comprises the two former; for the writers on the plague of Marseilles observed, during the whole course of the pestilence, numerous cases which presented in succession several symptoms referable to both the foregoing grades; so that most of the signs characterizing the second were the precursors of those attending the first form, which always indicated the rapid extinction of life. In these the buboes receded; and if carbuncles had advanced, they rapidly assumed a more extended and gangrenous form.

20. *D. The fourth state* or class of cases consists of those attacked with the same symptoms as are noticed in the second grade (§ 18), but these symptoms abate more or less on the second or third day, either spontaneously or from the effects of treatment, and almost always owing to a considerable eruption of buboes and carbuncles which seem to have concentrated the morbid leaven, and which, proceeding on towards suppuration, in this way procure the recovery of the patient.

21. *E. The fifth grade* or class of cases comprises all those in which there is no febrile or other disorder, or but very slight disturbance, but which present buboes or carbuncles, or both, that either go on to suppuration, or become hard or chronic, or are more rarely resolved without occasioning any unfavourable result. Thus there were seen at Marseilles a number of persons of both sexes who went abroad, lived as usual, and experienced but little or no impairment of strength, and yet were affected with buboes and carbuncles, or with one or other.

22. *a.* M. Gosse, one of the most recent writers on the plague, and who saw the disease during its prevalence in Greece in 1827 and 1828, furnishes some interesting particulars as to its history. He remarks that the contagion produces a form of the distemper which, as respects the primary local symptoms, very closely resembles *malignant pustule*, or anthrax: this is the *carbuncle*. First, there appears in some part of the skin, but especially on the limbs, the arms or neck, a small brownish spot, like a flea bite, attended by an itching and smarting, and afterward by a burning heat. This spot increases to the diameter of three or four lines, assumes a violet hue, and is covered by a flattened vesicle or phlyctena formed of the detached epidermis. The base is hard, and swollen like that of a boil. In a short time the central part assumes a bluish black appearance, and the margins, as they diverge from the centre, form concentric circles of a violet tinge, then a dark purple, a bright purple, &c., or they assume an erysipelatous appearance. The black centre extends rapidly, as well as the surrounding areola. When this *carbuncular pustule* has reached the extent of an inch and a half in diameter, it generally about the third day continues for a short time stationary. In some rare instances vascular reaction is developed around the gangrenous centre, an inflammatory circle is formed between the living and dead parts, suppuration takes place with symptomatic fever, and detaches the central slough, and the disease terminates. But much more frequently inflammatory action is either not established around the gangrened part, or, if it exist, it is insufficient to separate or throw off the slough; absorption takes place, and the poisonous fluid of the part is absorbed, contaminating and inflaming the lymphatic vessels and glands, so that red lines may be traced from the carbuncles to the glands through which these vessels pass, these glands rapidly becoming most painful and swollen. When the patient is robust, and the case proceeds favourably, the glandular enlargement increases rapidly, and the pains in the glands are acute and lancinating. The *buboes* thus formed tend rapidly to suppuration, with moderate symptomatic fever; and if the patient is guilty of no imprudence in diet or otherwise, and if his vitality is sustained, the suppuration proceeds favourably. While the buboes are developed the carbuncles extend, the gangrenous portion or central slough tends to separate from the surrounding inflamed tissue, suppuration is established, and the central slough is detached, leaving a deep wound, which is often slowly healed. In some cases the slough thus detached is very large. When suppuration takes place in the buboes recovery generally follows; but if the patient be weakened by any cause, or be depressed by cold, by mental anxiety, or disordered by indigestible food; if a temporary swelling of the glands merely occurs, the tumour disappearing without passing on to inflammation or suppuration; if, especially, no buboe follows a carbuncle which has not suppurated, the constitutional symptoms assume the worst form, and soon pass into dissolution.

23. *b.* The *other form* of plague, according to M. Gosse, instead of presenting the local or external symptoms as the primary and prominent phenomena, manifests intense affection of the whole system from the commencement. Chills or rigours, with acute frontal headache, noises in the ears, vertigo, or a stunning sensation or confusion in the head, are first com-

plained of. A sensation resembling sea-sickness is often felt, and these are generally followed by all the worst symptoms mentioned when describing the first and second grades of the distemper (§ 17, 18).

24. *c.* De Mærtens describes the *carbuncle* of the plague to be a gangrenous spot in the skin, resembling that caused by a burn. It consists of a reddish spot covered by small vesicles, which are pale, livid, or black, and surrounded by an inflamed circle; and passing quickly into a black, hard eschar. The term *anthrax*, he states, is usually applied to a sore resembling the carbuncle, but is larger and more elevated. It penetrates deeper, and is surrounded by pain and inflammation. Carbuncles are found on the neck, on the cheeks, the chest, the back, and the extremities, sometimes even on the bubocs. The anthrax is seen chiefly on the neck and back. Carbuncles sometimes appear without buboes; frequently they accompany these swellings of the glands, or even occur later than they. M. Aubert remarks that carbuncles rarely appear alone, but are generally followed or preceded by buboes; and that the plague, termed carbuncular, is not the more dangerous, especially if the carbuncle is solitary. He adds that the largest carbuncle which he has seen was on the middle of the back, and was four inches in diameter; the cicatrization of it was very slow. He has met with as many as eleven carbuncles in the same case; and with an instance of a pregnant female, who died of the plague, having a carbuncle on the breast. She was delivered of an infant of seven months during her illness, and it had a carbuncle on its forehead.

25. *d.* The *petechiæ*, which are seen in plague, are stated by De Mærtens, Aubert, and others to be a most unfavourable symptom, and to occur chiefly at an advanced period, or shortly before dissolution. M. Aubert, however, remarks that he has seen recoveries after the appearance of petechiæ. They are always in this pestilence round, purplish, or black, varying from an almost imperceptibly small point to the diameter of two lines; and are found on all parts of the external surface of the body as well as on the internal surfaces. *Ecchymoses* more immediately precede death; and proceed from effusions of blood of greater or less extent in the cellular tissue and membranes, owing to loss of the vital cohesion of the capillaries and tissues, and of the crasis of the blood. Hodges, Morea, and others mention certain eruptions, *marks*, or *tokens*, which are very different from petechiæ or the furuncular pustules now described. They are small tubercles, somewhat resembling warts, callous, and more or less deficient in sensibility; varying in size from that of a millet seed to that of a bean. They are probably merely a modification of the early stage of carbuncles in the more unfavourable cases.

26. *e. Various modifications* of the symptoms are observed during the prevalence of this pestilence. Hodges mentions cases of persons who walked about, or presented the appearance of health, and partook of their usual meals, and yet had the most unfavourable signs of the distemper in various parts of the surface, death taking place in a few hours. Some became delirious immediately after being seized, and wandered about until they fell down exhausted and dying. In the plague of Noja, it was observed by Morea that when buboes appeared in the neck, especially near the carotids, the eye on the same side as that presenting the buboes became inflamed, and ultimately destroyed. Rensa states that he has seen persons so little affected by the disease as to walk about, to eat and drink as usual, and to dress their own buboes. Those who have been already affected by the pestilence generally escape during subsequent epidemics, or experience in rare instances a modified attack, or merely pains in the cicatrices of old sores and buboes.

27. *f. A secondary and modified attack of plague* is occasionally met with, although a person who has been once infected is generally secure against a second seizure. M. Gosse states that in Turkey and Greece, those who had been already attacked, and who presented the cicatrices of buboes or carbuncles, were employed in preference to others as attendants on the sick; and that, although they took no precautions in waiting upon the infected, slept and ate near to them, handled their clothes and persons, and interred them after death—although exposed to the influence of infection in its full intensity, they generally escaped a second attack of the distemper. Many of them, however, experienced pains in the cicatrices of the old buboes without any other ailment. A few complained during a subsequent epidemic of headache or vertigo, or disorder of the stomach and general debility. Others had slight enlargement of the glands in addition to these symptoms, and but very rarely new carbuncles or sores appeared. M. Gosse mentions only one case in which the second attack was so severe as to terminate fatally. This person had been much exposed to the effluvium proceeding from the fetid evacuations of the sick, upon whom he was an attendant. He was soon after infected, and died on the sixth day of the disease.

28. ii. Stages or Periods.—Although this distemper may consist of only *one stage* in its most aggravated cases, that one being characterized by rapid sinking of the powers of life, as manifested by the nervous and vascular systems and internal organs, still it much more frequently exhibits the several periods into which febrile, exanthematous, or other diseases, attended by vascular reaction, have been usually divided. These periods have been variously divided; but they may be described as follows, and as they appear in the majority of cases.

29. *A.* The *period* which elapses between the first impression of the exciting cause and the actual manifestation or irruption of the symptoms of plague has been differently estimated by different writers. The *duration* of this period obviously depends upon the intensity of the cause, relatively to the susceptibility of the patient—upon the dose of the poison infecting the individual. During devastating epidemics, when it may be presumed that the infectious agent or poison exists in its greatest intensity, and when its activity is augmented by an increased susceptibility of infection among the great majority of the community, this agent produces its effects with more or less rapidity. In some instances where it may be presumed that the morbid effluvia from the bodies of the

dead, or evacuations of the diseased, have been more than usually abundant, the effect upon those very nearly exposed to them has been most depressing, and almost instantly overwhelming to the powers of life. Many writers have mentioned the seizure of persons thus circumstanced as suddenly as if they had been struck by lightning, vital exhaustion proceeding most rapidly, with a feeling of the utmost internal anxiety and distress, and terminating in fatal sinking in an hour or two. In these cases, and even in many of much longer duration, the malady admits not of any division into *stages* or *periods*, these having, in fact, consisted of only one stage, namely, that of progressive exhaustion of the powers of life, following immediately after the impression of the exciting cause, and terminating fatally with great yet variable rapidity. In these, as there is no variation in the course of the distemper, so there can be no division of it into stages; and there is also no *latent period* between the impression made by the poisonous agent and the manifestation of its effects—no period for the incubation of the morbid seminium, the fatal results of which are rendered instantly apparent in such cases.

30. In different circumstances, however, and in the large majority of instances, the distemper requires a longer or shorter period from the time at which its cause has infected the system before its effects are apparent. This period, which has been denominated that of *incubation*, or the latest stage of the malady, cannot be said to exist in the circumstances just mentioned; and even in some of those which are now about to be considered, it is often of so short duration as either to be entirely overlooked, or to attract but slight attention. In these, as well as in other cases, when the period between infection and the irruption of the distemper is much longer, the patient is not generally in sound health during the interval. Although no complaint may be made and but little ailment is felt, still more or less of malaise, or lassitude, or slight disorder may be detected; at last, after a period varying from a few hours to several days, the *actual manifestation* of the distemper, inaccurately called the *period of invasion* by many writers, takes place, and the malady proceeds in its usual course. It is fully ascertained that the morbid phenomena may instantaneously follow the impression made by the poisonous effluvium upon the susceptible, when it is intense, relatively to the grade of susceptibility; and that they may follow at periods more remote from such impression; but the extreme duration of this period has not been precisely ascertained. Seven, eight, or nine days have been viewed by many as the longest period during which the infectious emanation operates its effects, in a silent or latent manner, in the frame of the recipient before it explodes in open disease. It is even possible that a longer period may sometimes be required, especially when the distemper is merely endemic or sporadic, when the dose of the infecting poison is weak relatively to the susceptibility of the recipient, or when the action of the poison is resisted by the constitution and circumstances of the patient. It is also obvious that in this, as well as in all other infectious distempers, as will be shown more fully hereafter, persons whose susceptibility is by no means great may altogether escape, although very much exposed to infection, until some depressing agent or influence comes in aid and determines the operation of the exciting or infecting cause, as I have more particularly explained in the article Disease (§ 61).

31. *B. The period of irruption or invasion* usually appears with a short chill or rigour, nausea, lassitude, vomiting, severe pain of the head and præcordia; continued anxiety; a sense of internal heat referred to the stomach and bowels; vertigo, with a staggering walk and appearance of drunkenness. The spirits are depressed to a state of apathy; the features are pale, collapsed, sometimes turgid or bloated; the tongue is coated with a white mucous crust; thirst is urgent and constant; the skin dry and hot; and the pulse most variable, usually quick, but at one time weak, small, and irregular, at another more full and equal. The vertigo, headache, and drunken appearance of the countenance soon pass into delirium, with jactitation, restlessness, and tremour of the limbs and tendons, often passing into profound lethargy. Sometimes difficulty of breathing, pain, and oppression at the chest; hoarseness and cough; a sense of burning heat at the præcordia, and occasionally throughout the thorax; and, in some cases, slight expectoration of blood, or more copious hæmoptysis, are present from the commencement. These symptoms are often increased by the accession of vomiting, or of borborygmi, or meteorismus, or diarrhœa.

32. *C. The eruptive period* may occur after a few hours, or in the course of the second or third, or even the fourth day. After the rapid aggravation of the foregoing symptoms, stinging and lancinating pains are felt in parts of the surface, followed by the appearance of *carbuncles*, in the manner already described (§ 22), and generally, either subsequently or contemporaneously, by tumours of the lymphatic glands, or *buboes* (§ 22). These are developed with greater or less rapidity, and with an increase of all the constitutional symptoms, which present a more marked malignancy as they continue. The nervous systems of organic and animal life evince extreme depression and disturbance, and the vascular system remarkable loss of vital tone. The delirium is either furious, or resembles violent intoxication, or it sinks into a stupid muttering or typhomania, or into complete sopor. The face is lurid, or of an earthy or leaden hue; the eyes are watery, suffused, and the lachrymal carunculæ red and congested; the tongue is dark, contracted, dry, and tremulous, sometimes almost black; the voice is hoarse or altered; the speech rapid, hesitating, interrupted, or stammering; vomiting is constant, irrepressible, attended by hiccough, and the matters ejected have a putrid odour; the perspiration is cold, viscid, and most offensive, and the surrounding air is sickening and fetid. The carbuncles sphacelate; the buboes either subside or pass into an ichorous ulceration; petechiæ, vibices, or ecchymoses appear; subsultus tendinum and convulsive movements supervene; and the pulse becomes soft, weak, small, irregular, or intermittent, with faintness, sinking, deafness, and loss of sensibility. These symptoms, which are often variously grouped, differ but little from those

of putro-adynamic and true typhus fevers, excepting in the appearance of carbuncles and buboes.

33. *D. The period of crisis* supervenes; but the distemper may terminate fatally with the symptoms of vital depression, and of dissolution of the vital cohesion of the tissues just mentioned, at any period from the second to the seventh day. When it proceeds so rapidly as to terminate in death on the second or third day, the stages of its course are generally but imperfectly marked, at least according to the division of them adopted by Hildenbrand, and followed by Naumann. But when the attack is less severe, and when it is prolonged to the sixth or seventh day, a favourable change frequently occurs on the latter day. The pulse is fuller, more equal, and stronger; a general, warm, and copious perspiration breaks out; the sloughs of the carbuncles begin to separate, and the buboes assume a healthy suppuration. The alvine and urinary evacuations are also improved, although a crisis is more rarely indicated by them than by the external surface and sores.

34. *E. The decrement* or cessation of the distemper is generally gradual and slow when the attack has been severe, and when the carbuncles and buboes have been large, open, and foul. When the disease has been milder the symptoms disappear more rapidly, a resolution of the buboes taking place without suppuration occurring; but in all cases where the buboes go on to the production of a morbid matter, either infiltrating the cellular tissue surrounding the diseased glands, or breaking externally, a healthy suppuration is requisite to returning health. Hence *convalescence* is more or less prolonged by the severity and extent of the external sores, as well as by the violence of the preceding constitutional affection, by the profound alteration and depression of the powers of life in all the vital organs, and by the conditions of the circulating fluids.

35. *F. The duration* of an attack of plague varies from an hour or two to six or seven days in fatal cases. According to M. Morea, death generally occurs before seven days. When recovery takes place, the suppuration and healing of the carbuncles and buboes greatly protract the distemper, at least the early period of convalescence from it. In slighter attacks, when no foul and open sores are formed, recovery is much more rapid, and the duration of the distemper is much shorter, but of an indefinite duration, under nine or eleven days, no precise period having been remarked.

36. II. Appearances on Dissection.—M. Rigaud, lately physician to the European Hospital at Alexandria, states the following to have been the results of his examination of the bodies of sixty-eight subjects of the plague. The exterior of the body, when death has ensued rapidly and without any medical aid, is bluish and dark-violet, in large, irregular patches, especially about the head, the neck, and upper extremities, the surface appearing as if rubbed over with mulberries. This discoloration, which is often absent when death has taken place slowly, is accompanied with petechiæ, varying in size from a flea-bite to that of a vetch. One or more carbuncles and buboes are found in the situations already specified (§ 22). The usual cadaveric stiffness is present. —*a*. The membranes of the *brain* are injected with black blood. The vessels beneath the arachnoid are greatly distended. This membrane is, however, rarely thickened; it is mostly adherent, by a buffy and granular transudation, to the upper and inner parts of the hemispheres of the brain. Sanguineous effusions are observed in some cases; but more frequently the cellular sub-arachnoid tissue is infiltrated with a serous fluid, sometimes yellow, or even purulent-looking. The cineritious substance of the brain is of a deeper colour than natural; and the white substance, when sliced, shows very numerous bloody points. A little limpid serum is found in the ventricles. The choroid plexuses are of a reddish violet colour, like the lees of wine. The brain is seldom softened. The membranes and substance of the spinal chord are generally in the same state as those of the brain. The cephalo-spinal fluid is in excessive quantity.

37. *b*. The *lungs* are generally found more or less altered, but the lesions are often consequences of antecedent maladies. They are often rose-coloured on their exterior and anterior surface, but sometimes pale yellow, marbled with blue; these appearances are, however, seen only when they are bloodless. Posteriorly they are always of a deep violet, their vessels being gorged with black and thick blood. The *pleura* is always of a dark red, with numerous adhesions. Effusions of a yellowish serum in considerable quantity are frequently met with in the pleural cavities. The *pericardium* usually contains from half a pint to a pint and upward of serum. The *heart* seems increased in volume, and its superficial vessels are congested and well defined. Spots like petechiæ are observed over the left cavities. The right cavities, the auricles especially, are distended by black blood, sometimes clotted, but always gluey. On the left side the cavities are empty, with the exception of a very little blood in the ventricle. The substance of the heart and its inner membrane are unaltered. The *arteries* are always empty; the *veins* are, on the contrary, distended, and full of black clotted blood, the jugulars more particularly. While the inner coat of the arteries presents no alteration, that of the veins is spotted largely and irregularly, as if with ink.

38. *c*. The *pharynx* and *œsophagus* are commonly natural; and this has been the case even with the latter, when appearances of intense inflammation have existed in the cardiac orifice of the stomach. The *peritoneum* is always of a pink or bright red tinge, and the vessels are seen beneath it largely gorged with black blood. The adipose tissue is injected and reddened, sometimes darkish, like lees of wine. The *stomach* is often distended by gas. It frequently contains a quantity of a dark viscid fluid, like a mixture of bile and putrid blood. The mucous membrane varies in colour from pink and bright red to a brown, bluish, or leaden tinge, and often to a bronze green. Large ecchymosed patches and petechial spots are also observed in the internal surface. The internal coats are remarkably softened, and sometimes ulcerated. The *intestines* present the same changes as the stomach, excepting the colon, which is somewhat contracted. Lumbrici,

and less frequently tæniæ, are found in many cases. The *mesenteric glands* are engorged and blackish, and the whole *glandular system* is more or less altered. The *liver* is almost always enlarged, especially its large lobe, which presses up the diaphragm very much on the right lung. Its vessels are engorged; its substance somewhat softened, but not otherwise altered. The *gall-bladder* is double, or nearly triple its usual size, containing a thick, greenish-black bile. Petechial spots are seen beneath its peritoneal covering. The *spleen* is much augmented in volume, softened, friable, and pulpy. The *kidneys* are engorged with blood; the ureters are arborescent, with a red hue along their entire course, or covered with black spots, or even wholly blackened, as if with charcoal or ink. The *urinary bladder* is commonly half contracted, and its inner membrane presents the same appearances as those of the stomach and intestines.

39. *d.* These changes were observed in Europeans who had died in the hospital in Alexandria, and who had been addicted to every kind of excess; but they differ but little from those found by other physicians who have observed the disease in various countries and epidemics. Petechiæ have been remarked in all the viscera, especially in the mucous surface, where, also, ecchymoses and large dark spots have been very common. The carbuncles said to have been found by the older writers on this pestilence in the abdominal and thoracic organs have manifestly been those large ecchymoses or exudations of blood in the tissues, more accurately observed by recent writers. M. Lachaise, in his description of the changes in the bodies of those who died of the Egyptian plague of 1835, states that the whole lymphatic glandular system was diseased, internal as well as external. These glands were more or less engorged, enlarged, often softened and discoloured. The spleen was always very much enlarged, and so remarkably softened as not to admit of being handled. In all cases when black vomiting had occurred, the mucous surface of the stomach was not only ecchymosed and softened, but also ulcerated, the ulcers being very small and often numerous, and apparently the consequences of the ecchymoses, or small effusions of blood in and under the mucous or villous membrane. Red petechiæ and small rounded ecchymoses were also frequent under the serous surfaces. He adds, that all the parenchymatous organs were engorged with fluid black blood, which had frequently gone on to decomposition, causing the presence of gas, which was often remarked. M. Aubert states that he observed the ganglia of the great sympathetic engorged with blood, and presenting numerous red points externally, and internally the colour of wine lees. M. Lachaise mentions the frequency of red points in the nerves arising from extravasations of blood in their neurilema.

40. *e.* All recent writers concur in remarking the very sensible *alteration of the blood* in this pestilence even during the life of the patient. Blood drawn from a vein, even early in the distemper, does not separate into a coagulum and serum, and there is no fibrinous portion or buffy coat. These elements remain mixed together, presenting the consistence of cream. During venesection the blood presents, as it flows, the same dark colour at the close as it did at the commencement of its abstraction; and it often emits a peculiar odour. After standing, drops of oil often appear on the surface, and the whole mass speedily undergoes putrefaction. M. Bulard states that M. Rochet analyzed the blood in three cases. The blood was taken from three young and plethoric men, and from the third to the fifth day of the distemper. In 100 parts there were only six tenths of fibrin, and it contained sulphuretted hydrogen gas. It was always more dense than in health. The venous trunks contained blood, presenting the same appearances and chemical constituents as that taken away by venesection. The blood in these vessels was fluid and black; it appeared as dissolved, and often contained small oily drops.

41. III. Diagnosis.—Plague is often distinguished with great difficulty from other malignant or low fevers on the first breaking out of an epidemic, so that physicians who have been in the habit of seeing plague patients have been deceived in some instances. The difficulty, however, is only felt at the commencement of an epidemic, and when neither carbuncles nor buboes appear. When these are present, or even either the one or the other, then the nature of the distemper is made manifest. During the prevalence of an epidemic plague, a white chalky tongue, a quick and rapid pulse, and headache, are sufficient proofs of an attack, although neither carbuncles nor buboes, nor even petechiæ are present. The septic or putrescent disposition, although greater in this pestilence than in others, is not sufficient to distinguish it in many cases, and especially early in the attack; but, when the affection of the glandular system becomes apparent either alone or conjointly with the other symptoms of malignancy, or signs of a septic tendency, then no doubt of the nature of the distemper need be entertained.

42. IV. Prognosis.—The prognosis in this distemper has been more fully stated by Diemerbroeck than by any other writer. He remarks that no dependence, in general, could be placed upon critical changes occurring even in the critical days; when, however, they take place on the sixth day, the disease is always fatal; and he adds, that those who are seized at new and full moon rarely recover. A seizure after a fit of anger, after terror, dread, or anxiety, and after sensual excesses, is especially to be dreaded. The commencement of the distemper during warm, humid weather, and a still or calm state of the air, in warm countries, or during the summer or autumn in colder climates, and in low, close, foul, and crowded localities, among a population insufficiently nourished, prone to excesses, and neglectful of cleanliness, is generally followed by a rapidly diffused and fatal epidemic. I shall treat of the prognosis with reference, in succession, to the chief functions of the economy, according to the information furnished by the most experienced writers.

43. *a. The circulating organs* sometimes fail of furnishing those indications of the result which might be expected from them; but this may be owing as much to deficiencies in the observer as to the conditions of these organs.

Faintings, syncope, or marked impairment of the *heart's action*, or palpitation at the time of seizure, or soon afterward, are generally unfavourable. An irregular, unequal, small, weak, and very soft *pulse* during the course of the distemper, and an intermittent, small, weak, and creeping pulse at an advanced period, are generally fatal. A rapid, quick, open, and expansive pulse at the commencement, or early in the attack, is also unfavourable. An even, not very frequent, or even an almost natural pulse, cannot be relied upon as indicating a favourable result unless accompanied by other favourable symptoms. Diemerbroeck remarks that a pulse nearly approaching the natural state is deceitful, and that an intermitting pulse is always fatal. The state of the *blood*, as shown after venesection, or by the appearances of the mucous and cutaneous surfaces, and considered in connexion with the heart's action and pulse, also indicates the amount of danger, evidence of serious change in this fluid leaving but slight hopes of recovery.

44. *b. The nervous systems*, especially the *organic nervous system*, often furnish evidence of the ultimate result from the beginning of the attack. In some cases the *cerebro-spinal system* is not remarkably affected even during the whole course of the malady; the intellects are not disordered, and muscular power and action are often so far retained as that the patient is enabled to walk about until shortly before dissolution; and although the pulse may have disappeared from the extremities, he can, in some instances, change from one part of the chamber to another. When, however, the powers of the mind are impaired, depressed, or otherwise disordered at the commencement, or when violent or low delirium occur early, and when apathy, lethargy, stupor, or complete coma appear, the distemper generally terminates fatally. Tremour of the tongue and hands; convulsive movements of the extremities or other parts; contractions or startings of the tendons, generally indicate dissolution, especially when associated with delirium, stupor, or coma.

45. If all the functions which are actuated by the *organic nervous system* be remarkably depressed or otherwise disordered; if the digestive, the assimilative, the excreting, and the circulating functions are either arrested or remarkably impaired; if the vital or chemical conditions of the blood be visibly altered; and if the vital cohesion or tone of the capillaries and of the several tissues be manifestly diminished, occasioning passive hæmorrhages and discolorations of the surface, recovery rarely takes place, especially if these changes are very apparent. Diemerbroeck remarks that epistaxis is dangerous on a critical day, and fatal on a non-critical day. Other hæmorrhages are even still more dangerous.

46. *c.* The *tongue* often indicates the result with much certainty. When it becomes black, or very dry and contracted at the commencement, an unfavourable issue may be expected; but when it preserves a natural appearance and continues moist, or when it regains these appearances, recovery may be anticipated. Severe affections of the *throat*, or pain in this situation, even although there may be neither dryness, nor aphthæ, nor tumours, or other manifest cause, often announces a fatal termination. Exudations of blood from the gums, tongue, mouth, or throat, are equally unfavourable.

47. *d.* If the symptoms referable to the *stomach* and *bowels* are severe at the commencement, and especially if *vomiting* be exhausting, frequent, or continued; if the matters ejected be black or unnatural; and particularly if it be attended by singultus, death will ensue. When, however, vomiting is moderate, and when it ceases after the evacuation of green, or greenish-yellow, or bilious fluids, a favourable result often takes place. The occurrence of *diarrhœa*, and even of looseness, especially if the motions are black, or sanguinolent, or give out a very offensive, putrid, or unnatural odour, is generally fatal. On the contrary, *costiveness*, or a natural state of the bowels, at the commencement and during the increase and decrement of the distemper, is a very favourable circumstance.

48. *e.* A free, tranquil, and easy state of *respiration* furnishes just grounds of hope; but the more serious disorders of the respiratory organs are most unfavourable. A short cough, short and difficult respiration; a burning heat or pungent pain, or tightness in the thorax; bloody expectoration or hæmoptysis; and signs of pneumonia or of pleurisy, are severally indications of a fatal issue. Frequent sneezings and remarkable fetor of the breath, or an odour of putrefied flesh furnished by the expired air, are indications of approaching dissolution. Alterations of the voice, a rapid or interrupted, or very slow or stammering enunciation, inarticulate or confused speech, are all unfavourable signs.

49. *f.* The *urine* generally fails to furnish any certain indications of the result; and I can find no exact information respecting its chemical conditions in this pestilence. Diemerbroeck observes that a turbid urine was unfavourable; nevertheless, some escaped who passed this urine, while many died suddenly or rapidly, although the urine was natural, and that in some of these the symptoms did not appear dangerous. He adds, that a thick, oleaginous, brown, or blackish urine, or that furnishing a brown or black sediment, was generally a very unfavourable symptom. Those who discharged blood from the urinary organs, either mixed with the urine or distinct from it, he states, died in a short time. Hodges remarks that very offensive urine is a fatal symptom.

50. *g.* The appearance of the *catamenia* during this pestilence is dangerous, even upon a critical day; and most writers view this occurrence as fatal when it takes place on a non-critical day. Hodges says that every hæmorrhage is bad, but a flux of the menses is fatal. Women who are pregnant, or lying-in, or threatened by abortion, rarely recover when seized by this distemper; and they are in great danger of being attacked when it is epidemic, unless excluded from all possible medium of infection. Infants born either prematurely or at the full time, after the mother has been seized by the plague, have sometimes presented proofs of the disease having affected them *in utero*, and the distinctive characters of the distemper.

51. *h.* The *external surface* furnishes by its appearances the most certain evidence of the issue of the distemper. When a warm, genial,

and general *perspiration* breaks out, no symptom assuming a worse character, a favourable result may be expected. But when the perspiration is clammy, viscid, very offensive, or cold, or even although it be general, when the symptoms are aggravated, or the patient becomes weaker, or feels a sense of sinking, then the distemper terminates fatally. Hodges remarks that "the most certain fatality of all is from such sweats as have a cadaverous smell, although there was sometimes a disagreeable scented sweat, with which they recovered, as with it exhaled the pestilential venom." (P. 144.)

52. *i.* The *glandular tumours*, or buboes, characterizing this pestilence often furnish the best evidence of the issue. The early appearance of these tumours, especially before or without febrile symptoms, is a favourable circumstance; but it is very different if they follow the fever, or if the febrile symptoms are very severe or intense. The occurrence of these tumours below the ears or in the neck, and especially if they increase rapidly, or in the course of ten or twenty hours, or if they be soft, fluctuating, or boggy, either with or without inflammation, is always fatal; and although some patients with tumours thus situated and characterized may not appear otherwise very ill, they die nevertheless. If, on the other hand, the tumours are hard at the commencement, tense and oblong, and increase gradually or slowly, with a moderate degree of pain, and if they continue hard during their increase, a favourable result may be anticipated; and with more certainty if they pass on to suppuration; or when the fever has ceased, they gradually disappear without suppuration. But if hard buboes are surrounded by a circle resembling an iris, or if they assume a dark or fiery red, or a livid or black hue, or if the buboes disappear suddenly, the fever still continuing, death generally takes place. Hodges remarks that "the more buboes there are, so that they suppurate, the better. Carbuncles are always more dangerous than buboes." (P. 140.) Dr. Morea observes that buboes in the armpits are always attended by danger, and an inflammatory affection of the eyes, with difficulty or other disorders of respiration, generally accompanies them, these and other symptoms becoming worse unless they enlarge and suppurate, when an amelioration takes place; but if they remain stationary, or subside, death always results. (*Op. Cit.*, p. 427.)

53. *k. Carbuncles* appearing in fleshy parts, from the commencement of the distemper or soon afterward, are favourable; but if they are seated over or very near the buboes or enlarged glands, over the spine, or on the fingers or toes, they indicate great danger. If they break out slowly there is much risk, and if they are numerous there is still greater risk. If, in the course of two or three days, they are surrounded by a red circle, they generally heal easily and soon; but if they continue to extend, without a disposition to become limited, or if they reach a great size, there is danger, or at least there will be great difficulty in healing them. The prognosis should he still more unfavourable if they are seated on the spine, or over large blood-vessels or nerves. When they disappear suddenly, or when they dry up, the febrile or other symptoms still continuing, a fatal termination soon follows. Hodges says that "the smaller the carbuncles, and the more remote their situation from the viscera, greater vessels, tendons, and nerves, and the fewer they are in number, by so much it is the better; and, on the contrary, when they spread like a gangrene, and are near the principal parts, as the breast or belly, and also are numerous or livid, the fate of the patient may be pronounced desperate." (P. 147.)

54. *l. Petechiæ*, *ecchymoses*, or *spots* of a violet, purple, black, or greenish hue, whenever they may appear, always indicate a fatal issue. A few escape when the petechiæ are red, but even this is an unfavourable symptom.

55. *m.* Dr. Castro remarks that evacuations occurring spontaneously in the course of febrile diseases, especially on critical days, are favourable circumstances; that they are quite otherwise than favourable in plague. Diemerbroeck observes that he has always considered *issues* and *setons*, made with a view of protecting the individual from an attack of plague, as most serviceable, even although he may be seized nevertheless; for if these continue to discharge fully during an attack, the pestilential venom seems to discharge itself by these channels; but if they dry up, or cannot discharge, during an early or more advanced period of the distemper, death will certainly take place. Of the protecting and favourable influence of *issues* on this malady, he quotes the opinions of Mercuriali, Hercules Saxonia, Garnier, Hildanus, Joannes Herculanus, and others in support of his opinion.

56. V. The Causes of Plague.—This subject, in some of its most important relations, has long engaged the minds of eminent medical writers. It has occupied a portion of the attention of the legislature in this country in modern times; and very recently it has been inquired into and discussed in the Royal Academy of Medicine in Paris. I have, in preceding sections of this article, fully examined the *causes* of the *cholcric* and *hæmagastric pestilences*, and have demonstrated the existence of *infection* as their chief and efficient cause. However this may be disputed by the interested, by the prejudiced, and by the insufficiently informed, I am confident of its truth. I have written with a full conviction of the soundness of the opinions I have entertained, and with a firm belief that time will not only test, but also prove their accuracy. The inquiry upon which I am about to enter will be prosecuted as follows: 1st. Is plague caused and propagated by infection? 2d. Infection having been demonstrated, in what does the infectious agent consist, and by what media is it conveyed or preserved? 3d. What are the circumstances, influences, and agents favouring or determining the action of the infectious or pestilential miasm? And, 4th. For what period may infection remain latent in the system until its irruption in a specific form; and how long may the infectious poison retain its powers when preserved in animal or other productions?

57. *A. Is plague caused and propagated by infection?* Conformably with the meaning attached to the word infection, in the use which I have made of it in the two preceding parts of this article, and agreeably to what I have sta-

ted in the article Infection, there can be no doubt of the proofs of the infectious nature of this pestilence being most complete, and convincing to all candid minds. In that article I have classed plague in the *third class* of infectious maladies, and have stated the *tests* and *circumstances* proving the infectious nature of this distemper, and of others belonging to the same category. (*See* Infection, § 4, 15.) Lest I may be viewed as having espoused a particular doctrine without sufficient evidence of its truth, I shall *first* adduce a sufficient number of the innumerable facts upon record proving the infectious nature of this pestilence, and *next* inquire into the objections which have been urged against a most important doctrine as respects the best interests of the community.

58. *a.* Plague has been generally considered as both an *endemic* and *epidemic* distemper; it has been viewed as endemic in Egypt and Syria, where, also, it is frequently epidemic, and only epidemic after various prolonged and indeterminate intervals, in most of the countries bordering on or approaching to the Mediterranean shores, and less frequently, or much more rarely, in those which are farther distant from them. It has been said to be non-infectious or non-contagious when appearing endemically, sporadically, or primarily; and to be contagious by some, infectious by others, and both contagious and infectious by many, only when it appears in an epidemic form. These views have been often hastily taken, and the terms in which they are expressed have been as loosely as inaccurately employed. The meaning which the numerous writers on the subject have attached to the words contagion and infection has been vague in most instances; different writers employing them with a different import, or with a different range of meaning; and even the same writer using them without either precision or distinction. From what I have stated in another article (*see* Infection), it will be seen that I have used *infection* as the generic term, and *contagion* as a form of infection, or as that infection of a healthy but predisposed body produced by immediate or mediate contact of a diseased body, or of the secretions of a diseased body, the contagious agent propagating a specific malady and perpetuating its kind. I have applied the term infectious to those maladies which are propagated and perpetuated without contact, and by means of an animal miasm or emanation, proceeding from the bodies of the diseased, and affecting predisposed or susceptible persons with a distemper identical with that which produced the infecting miasm or emanation.

59. Taking the most extended view of *infection*, and considering it a result of whatever may contaminate the fluids and solids of a healthy body, as I have done in that article, we shall find that *contagion* is a mode only of *specific infection*; and that while all specific infections proceed from more or less diffusive, or more or less consistent animal emanations or secretions, which affect the system through the medium of either the respiratory or the cutaneous or mucous surfaces, contagion is infection by those secretions which act chiefly by contact with, and through the medium of, the external surface of the body. It is obvious from this that, as the major includes the minor, so all contagions are also infectious; that infection has a wider range of acceptation than contagion; and that, among the several infectious agents, some act through the medium of the lungs, others through the medium of the external surfaces, and many through either channel, or through both, according to the circumstances or modes in which the infectious agent may be presented to the healthy frame. Thus infectious emanations or secretions from specifically infectious maladies may affect healthy predisposed persons: 1st. When diffused in the air either directly from the diseased body, or mediately from woollen, or body or bed-clothes, which had retained these emanations for a longer or shorter period, the air thus contaminated affecting the healthy through the medium of the lungs; 2d. When applied in a more or less consistent or tangible form to the cutaneous surface, or to the outlets of mucous canals; and, 3d. When presented to the healthy economy in either of, or in both these modes. Hence some distempers, as the two pestilences already treated of, are propagated and perpetuated in the *first* of those modes only; while others are communicated in the *second* of those modes, as itch, syphilis, rabies, &c.; and some are transmitted in *both modes*, as plague, smallpox, &c. The *first* order is simply *infectious*, the *second* is *contagious*, and the *third* is both *infectious* and *contagious*. (*See Art.* Infection, § 4.)

60. Much difference has existed among writers as to the country or countries in which the plague is *endemic*, or in which it is generated or its germs preserved; and as to whether or not it is always present in few or rare instances, although not commonly observed, when it is not generally prevalent—whether or not it is generated *de novo* in those countries, after intervals of entire extinction, or is the infectious poison always preserved by means of few or occasional cases, thereby imparting to it an appearance in those places of a sporadic or endemic distemper. Many of the ancients, as well as writers of later epochs, as Mead, Adolphus, Arbuthnot, Fodéré, and others, have considered Egypt to be the most productive source of this pestilence; while Prosper, Alpinus, Targioni, and Olivier have believed that, although frequently observed in this country, it is generally introduced from Ethiopia, where it is generated by a hot sun from a deep and rich soil, kept almost constantly humid by the rains, a malignant miasm being produced from this source, that constantly gives origin to a malady, whose effluvium propagates and perpetuates itself. Whether originating or not in these or other countries bordering on the Levant, and whether it arises from this or other sources, there can be no doubt of the rapid spread of this pestilence from person to person, especially in certain circumstances which evidently favour this diffusion, although the exact nature of these circumstances are often not very manifest, or altogether unascertained. That this malady is propagated in one or other of the three modes to which I have just now endeavoured to assign some degree of precision, cannot be denied by any one who has perused a portion of the annals of pestilential diseases with an un-

prejudiced mind; but the chief difficulty is to determine the particular mode in which it is transmitted; and it is by no means a matter of small importance that the exact mode or channel of transmission observed by this pestilence should be ascertained, inasmuch as upon it all protective and prophylactic measures should be based. After perusing the evidence which I shall have to furnish respecting the transmission of this distemper from person to person—and this evidence can only be, owing to my confined limits, a very small portion of that which might be adduced—the reader will readily come to a conclusion as to the channels by which this transmission takes place, even without that assistance which it is my duty to afford.

61. Dr. Hennen, who took great pains to investigate the origin and propagation of the plague in Malta in 1813, and who has confirmed the accounts of this epidemic furnished by Drs. Calvert, Faulkner, and Tully, remarks that "it has been among medical men, I am sorry to say, that doubts have principally arisen as to the contagious nature of plague. This gross and dangerous error, in point of fact, has sprung from that most fruitful source of deception—preconceived theory; and it has been aggravated by neglecting to define the terms employed, which is altogether inexcusable, and which has exposed us to no small portion of ridicule among the better-informed non-professional men who have interested themselves on the subject."

62. The signs or tests by which a disease may, with the utmost certainty, be proved to be infectious or contagious, or both the one and the other, have been fully stated in the article Infection (§ 15). Now whoever will examine the accounts of the plague furnished by those who have witnessed its ravages, will find most convincing evidence of the following truths: 1st. That it is most liable to attack those who approach patients affected with it, and that in proportion to the nearness of the approach; 2d. That those who avoid all intercourse with persons affected with the plague, generally escape the distemper. These are facts recognised and acted upon by all persons who have had opportunities of observing the progress of this pestilence; and there are few facts in medical history so well supported by evidence as these are, and as to which the experience of past and present times is so uniform and conclusive. A recent writer has remarked, that the most remarkable examples of the communicability of this distemper are afforded by the introduction of it into countries which had long been free from it, in consequence of intercourse with places in which it was then raging. The clearness with which this intercourse has been often traced is truly wonderful, considering the many temptations which travellers, traders, mariners, and commercial men, coming from countries where the plague is prevailing, have to clandestine intercourse, and the frequency of deception practiced by illicit dealers, smugglers, and others. Of such histories, there are so many on record that the difficulty is which to select; although it must appear very difficult, if the subject be viewed in a proper light, to trace the origin of an infectious malady, especially when such malady may be propagated by the poison retained, even for a very considerable period, in articles of clothing and bedding. Indeed, in many cases of the importation of plague into places remote from or even approximating the Levant, several circumstances and occurrences have taken place, proving the introduction of the infection not by one channel, article, or person merely, but by several in the course of a few days; and thus the accounts given of the origin of the distemper have varied in some instances, and have thereby apparently weakened, although actually strengthening, the evidence of imported infection. Besides, the difficulty is greatly increased as respects this pestilence, as well as others, by the circumstance of a very large number, and sometimes all, the very earliest cases being either concealed or denied, or mistaken for some other fever: a fact of more importance than generally acknowledged in tracing the early history of an epidemic. Owing to the difficulties now adverted to, and to the fact of the plague appearing in places holding frequent intercourse with countries where it was raging at the time, the infection having been conveyed in more ways than one, several of the outbreaks of it in various parts of Europe during the 15th, 16th, and 17th centuries have been either imperfectly described or unsatisfactorily accounted for; but such is by no means the case with others, and especially the more recent. The plague appeared at Marseilles in 1720, after an immunity of seventy years. A vessel from Seyde, in Syria, arrived in that port on the 25th of May, after having lost several of the crew and of the passengers during the voyage by this distemper, and among these the surgeon of the ship. On the arrival of the vessel, the crew and cargo were landed at the lazaretto. Soon afterward the disease attacked, in succession, another of the crew, an officer put on board to superintend the quarantine, a boy belonging to the ship, two porters employed in unloading her, then four other porters, the priest who had administered the last sacrament to the sick, the surgeon of the lazaretto, and his whole family. Notwithstanding these events, the passengers, having performed a short quarantine of less than twenty days, were allowed to take up their quarters in the town, and to carry with them their clothes and packages, conformably with the advice of the anti-contagionists of that place and time. As Dr. Gooch has very justly remarked, when passengers, after a voyage of nearly four months and a quarantine of nearly three weeks, are at length let loose in a large city, their first employment is to roam about the streets; they have things to sell, and to buy, and to see. They come in contact, in the streets and in the shops, with persons whom they think no more about, and who think and know no more about them.

63. It is not surprising, therefore, that the exact traces of the distemper should be lost in all such circumstances, and that it should be often difficult, and even impossible, to follow the progress of it in its various courses towards the general infection of a community. Dr. Bertrand, a resident physician at Marseilles at the time, states that it is most certain that the plague was on board Captain Chataud's ship; that it was communicated to the infirmary by the merchandise with which it was

freighted ; that one of the first who fell sick in the city had been passenger in the ship, and had only quitted the infirmary a few days with his clothes and merchandise ; that among the very early victims of the distemper were the family of a famous contraband trader near the convent of the Carmes, and those of contraband traders residing in the Rue de l'Escale and vicinity ; and that the suburb adjoining the infirmary was attacked nearly at the same time as the Rue de l'Escale. I leave my readers to make the reflections naturally suggested by these facts.

64. Numerous incidents occurred, during the early prevalence of the pestilence in this city, proving the channels or modes of its extension ; but it is sufficient to notice one or two of them only. The Hôtel Dieu contained between three and four hundred foundlings of both sexes, besides the officers and attendants. A woman from the Rue de l'Escale presented herself at this hospital, stating that she was ill with a common fever ; for in this pestilence, as in many others, the first cases were not admitted to have been the plague, and numerous misrepresentations were made respecting them ; and hence the unrestrained progress of the mischief, and the loss of much valuable time, or, rather, the entire loss of that time, in which alone it could have been limited. She was taken in and conducted to her bed by two maid-servants. The next day the two maid-servants fell ill and died in a few hours. The day after, the matron, who had visited the patient, fell ill, and died almost as suddenly. The disease spread with amazing rapidity, and destroyed all the children, with every person belonging to the house, excepting about thirty, and these took the infection, but recovered.

65. An official report transmitted to Paris stated that the physicians and surgeons of Marseilles unanimously declared, "that when one person in a family was attacked and died, the rest soon underwent the same fate, insomuch that there were instances of families entirely destroyed in that manner ; and if any one of an infected family fled to another house, the contagion accompanied him, and proved fatal to the family where he had taken refuge."

66. The removal and interment of the dead, as the pestilence extended, were among the greatest difficulties experienced by the authorities of this city. At first, beggars and vagabonds were employed in casting away the dead bodies ; but these soon were seized by the distemper, "and those who followed them in their offices soon followed them in their fate." Convicts were then supplied from the galleys to carry away the dead, and promised their liberty if they survived. The first supply amounted to 133, but these perished to a man in less than a week. A hundred were next granted, and in six days they were reduced to twelve. The population of Marseilles was calculated, at the outbreak of the pestilence, at about 90,000 souls ; but many left the city when the distemper began to spread. Upward of 40,000 persons died ; so that, comprising those who recovered and who left the city, very few escaped an attack. But this pestilence was carried to Aix, Toulon, and various other places in Provence, in which upward of 80,000 persons died of it.

67. While the horrors attendant upon this pestilence were going on, intercourse was almost unrestrained, excepting in some places in which precautions were used to prevent communication with the infected, and which either escaped altogether, or in a great degree, according to the strictness with which the precautions were observed. When the distemper was admitted to be the plague, the galleys were detached from the shore, anchored in the middle of the port, and separated from other vessels. Three hospitals were appointed ; one for the crews, the others for the convicts. In the former, those infected with the plague were placed ; in the latter, those labouring under other diseases were kept. To the third, all doubtful cases were sent. The population of the galleys amounted to 10,000, yet 1300 persons only were attacked, and about half recovered. There are various ways in which precautions against intercourse with infected persons, and against the introduction of infected substances, may have been evaded without detection ; but there is a very remarkable difference between the numbers attacked where no precautions were taken and where precautions were adopted, although they were most probably partially evaded. A certificate given by the Bishop of Marseilles states that "the plague has not penetrated into the religious communities who have had no communications with persons abroad, and who have used the precautions necessary to protect them ;" and another, given by the first sheriff of this city, states that "the families which were shut up and had not communicated abroad, particularly the nunneries, had been protected against this scourge, which was introduced into some of them by communications with strange persons."

68. De Mærtens, a physician of eminence practicing in Moscow, has given a full account of the plague which visited that city in 1771, after an absence of a century and a half. War commenced in 1769 between Russia and Turkey ; the next year the plague appeared in Wallachia and Moldavia ; and many Russians died of it in the city of Yassy. The following summer it entered Poland, and was conveyed to Kiow, where it carried off 4000 persons. At first, all communication was cut off between Kiow and Moscow ; but a colonel and two soldiers left Choczin, where the plague was raging, for Moscow. The colonel died on the road, but the two soldiers reached Moscow, were taken ill at the military hospital, and died there soon after their arrival. This occurred in November, 1770. Towards the end of this month the demonstrator of anatomy at this hospital was attacked by this distemper, and died on the third day. The male attendants lived with their families in two chambers separated from the others ; and in one of these eleven persons fell ill in a very short time with a putrid fever, attended by petechiæ in some, and by carbuncles or buboes in others, and most of them died from the third to the fifth day. The same distemper attacked the attendants residing in the other chamber. On the 22d of December eleven physicians assembled, and ten out of the eleven declared the disease to be the plague. The hospital was closed, and a military guard interrupted all communication. Those affected by the distemper, with their wives and children, were separated from the

rest, and the clothes and moveables of those who had died of the disease, and who were still ill with it, were burned. The weather became intensely cold, and the traces of infection were lost in the hospital and in the city. The communications with the hospital were opened in February, 1771, but on the 11th of March the physicians were again convoked, and Dr. Yagelsky stated that eight persons had been attacked in a large manufactory of military clothing, containing 3000 persons, situated in the centre of the city, with symptoms similar to those observed in the patients in the hospital three months before. The work-people declared that in the beginning of January a woman who had a tumour in the cheek had gone to the home of one of them, and that the disease had afterward spread in the manufactory, and 117 persons had died of it. The manufactory was closed and guarded; nevertheless, several of the work-people escaped on the following night by the windows. Precautions were taken to prevent the spread of the distemper, and an abatement of it became manifest; but these precautions were relaxed, and the progress of the malady became rapid. "Towards the end of July the mortality amounted to about 200 daily; by the middle of August, to 400; towards the end of the same month, to 600; at the beginning of September, to 700; some days afterward, to 800; and at length to 1000 daily. On the evening of the 5th of September the populace rose, broke open the hospitals, put an end to the quarantine, and restored the religious ceremonies used for the sick; the images of saints were carried with great pomp to the sick, and kissed by every one successively. The people, according to ancient custom, embraced the dead, and buried them within the city, declaring that human precautions were odious to the Divinity; they hunted down the poor physicians, broke their furniture, and sacked their houses. This riot lasted only a few days, but it was followed by the addition of two or three hundred to the daily mortality. Almost all the priests perished." The pestilence began to decline in October, and at length ceased with the end of the year. The mortality was estimated at more than 80,000, exclusive of that in the towns and villages to which the distemper had extended. In these the deaths were upward of 20,000; but they suffered much less, because in most places the inhabitants, taught by the miserable example of Moscow, readily permitted precautions to be used. Criminals were employed to bury the dead, and when these perished, the poor were hired to do it, and provided with covering of oil-cloth to protect them; but these, and the advice given them, were neglected. Most of them were attacked about the fourth or fifth day, and most of them perished. The plague was most fatal to the poor; nobles, gentlemen, and merchants generally escaping, owing to the precautions they had taken. Dr. De Mærtens states that the distemper was communicated only by the touch of infected persons or clothes, and that the physicians, who only inspected the patients, and who touched neither the bodies, nor the clothes, nor beds of the sick, generally escaped, but that a number died of the surgeons and assistant surgeons who touched the patients.

69. While the pestilence was ravaging the city, the Foundling Hospital afforded a remarkable proof of the salutary effects of seclusion. It contained 1000 children and 400 adults. All communication was cut off, and the plague never entered the building. One night four attendants and as many soldiers escaped from it, and on their return were attacked by the malady; but they were separated from the rest of the house, and no others were infected. The contrast between the fate of this hospital and that of the foundling hospital at Marseilles (§ 64) cannot fail to strike the reader.

70. The plague raged in Cyprus from April, 1759, until June, 1760. Dr. Russell states that it was introduced by a large Turkish vessel from Alexandria that was wrecked on the island in the month of April; and of the crew who were saved a great part were infected with the plague; and that, while numerous cases were occurring in consequence at Limsol and the vicinity, where the vessel was wrecked, a ship from Damietta arrived at Larnica and landed, on the 22d of May, infected passengers and sailors, who lodged in the houses and communicated freely with the natives. Another vessel from the same place arrived some time afterward with infected persons on board. During the hot months of July, August, and September little was heard of the pestilence, "but it continued lurking in these parts, showing itself only by starts," until October, when it greatly increased in those places where it had been introduced, and in the adjoining villages. The plague soon afterward appeared at Nicosia, to which place the annual fair had drawn a great concourse of people from most parts of the island. But the nature of the distemper was concealed, and the bodies were buried during the night to prevent alarm. It increased rapidly from this time, and destroyed about a third of the population of the island. The convents and European merchants observed seclusion, and wherever this precaution was strictly observed the distemper did not appear.

71. Dr. Russell, in his account of the plague, which raged in Syria during 1759, and three following years, states that it appeared first at Saffat in October, and had been brought there by some infected Jews, who came from Alexandria. It afterward spread to Sidon, Acre, Latakea, and Tripoli, and prevailed greatly in these places and the vicinity during the first six months of 1760. "Jerusalem received the contagion in January, and in the beginning of March it reached Damascus; in both which places, as well as in the smaller towns and villages of Palestine, it made dreadful havoc during the subsequent months." Dr. Russell, who was residing at Aleppo, remarks that at this time an extensive commerce existed between this city and infected places, and a total inattention to the means of prevention opened many channels for the reception of the distemper. Accordingly, the introduction of it soon took place; and in the following way: Three Turkish merchants, who had come in the Damascus caravan, were lodged in a public khan, near the British consulary house, and after a stay of a few days they set out from Aleppo on the 16th of May. Next day the porter of the khan, an Armenian, and his son were suddenly taken ill, and soon afterward the brother of

the porter. The son died on the 19th. These men had been in attendance on the Turkish strangers, and had assisted in moving and packing their haggage. Dr. Russell visited these two men on the 21st, and ascertained the existence of the plague, of which they died on the 22d and 23d. Towards the end of this month caravans arrived from Jerusalem and Damascus, in which were infected persons. These were, under various pretexts, refused admission into the city, but they encamped without the walls, and buried several persons during their stay; but several individuals found private lodgings in the town. The pestilence began now to prevail both in the suburbs and within the city; and the cases were numerous early in June; but it did not become very prevalent, and soon afterward subsided, although it extended to the villages scattered between the neighbouring mountains, and to various Arab tribes, and to the Bedouins, among whom it was remarkably fatal. During 1761 and 1762 the distemper continued, with varying degrees of prevalence and fatality, throughout this country. It became epidemic in these years, during May, June, and July, in Aleppo, and was most fatal in the last year; during the three years of its prevalence in Syria, the infection appeared to spread with varying degrees of rapidity in different places. While only straggling cases were observed in Aleppo, it was rapid in its progress among the Arab tribes in the vicinity; and when less prevalent among these, it extended more generally among the Turkish inhabitants of Aleppo. The higher classes and the merchants, especially Europeans, used more or less strict precautions, or entirely shut themselves up, and escaped in every instance where the precautions were strictly observed.

72. Mr. Jackson, in his account of the Empire of Morocco, states that the plague has visited this country about once in every twenty years; and that the visitation of 1799 was more fatal than any previously known. It first appeared in Old Fez, and was imputed to the importation of infected goods from the Levant, by some; and to the destruction of immense swarms of locusts, which had infested West Barbary during seven years, and been immediately followed by epidemic smallpox, which had preceded the plague. This pestilence pervaded the whole empire, and in many places did not leave persons living sufficient to bury the dead. Mr. Jackson resided at Mogadore during its fatal prevalence in that city. He states that the European merchants shut themselves up in their respective houses, as is the practice in the Levant, and escaped the pestilence; but that he "did not take this precaution, but occasionally rode out to take exercise." He remarks that his daily observations convinced him that the distemper "was not caught by approach, unless that approach was accompanied by an inhaling of the breath, or by touching the infected person." (P. 278.) He farther adds that, during the epidemic, he took "no farther precaution than that of separation, carefully avoiding to touch the hand or inhale the breath;" and he is of opinion that the plague is not produced by the atmosphere, but is "caught solely by touching infected substances, or by inhaling the breath of those who are diseased." It has been said, he observes, "that the cultivation of a country, the draining of the lands, and other agricultural improvements, tend to eradicate or diminish the plague; but we have seen countries depopulated where there was no morass or stagnant water for many days' journey, nor even a tree to impede the current of air, or a town, nor anything but encampments of Arabs, who procured water from wells of great depth, and inhabited plains so extensive and uniform as to resemble the sea." (P. 279.)

73. The plague of Malta, in 1813, is rendered memorable by the proofs of the introduction of the infection, and by the measures used to arrest it, founded on a belief of its infectious and contagious nature. The history of this plague has been recorded by Calvert, Faulkner, Tully, and Hennen, all of whom agree as to the fact of the introduction of the distemper. The pestilence had not appeared in Valetta for 137 years, and was now introduced by a vessel from Alexandria, where it was then prevailing. Two sailors had died of it on the passage, and after the arrival of this ship, the captain and his servant; soon afterward, a smuggler of the name of Borg, his wife, children, and father, were seized with it, and all died; then a midwife who attended the wife of Borg in the premature confinement caused by the plague, a young woman who slept in her house, a kinsman who entered her chamber and touched her body, the child of a master of a wine-house near the quarantine harbour, where, among others, the servants of the health-office who guarded the infected vessel in the harbour, and some of the guards of this vessel themselves, with whom Borg, the smuggler, had frequent dealings. While the distemper was attacking in succession the above-mentioned persons, it appears by the official statements that no other individuals were affected by it in any other part of Malta. It is admitted that there was no positive evidence beyond rumour of communications between this vessel and Borg and his family; but what evidence can be expected in this and similar cases of undetected smuggling? Rumour in such cases is often near the truth; and that it should be true in this, as to the secret conveyance of articles from the infected ship, is extremely probable. The facts of Malta having been free from plague for 137 years; the arrival of an infected vessel, from an infected port, at the principal city of the island; and the almost immediate appearance of this pestilence after the arrival of this vessel, are of themselves demonstrative of the introduction of it, without the particulars connected with the communications between the vessel and the city being proved—particulars, from their nature, and the circumstances of their occurrence, that cannot admit of proof, as being secret; and of a nature which, if detected, would have led to the severe punishment of those engaged in them. But it is not the mere introduction from a distance that proves the infectious nature of a distemper, but also the subsequent diffusion of it, and the means found to be successful in guarding against it.

74. At first the malady was confined to the crew of the vessel which came from Alexandria, and to Borg's family and those who had communicated with them; but it soon after-

ward appeared in the town of Valetta. At this time the medical men contended that the malady was not the plague; and those attacked concealed their sickness from fear of being removed to the lazaretto, clamoured against precautions, and did all they could to thwart them. Hence the distemper spread not only through Valetta, Floriana, and the adjoining towns, but also to many villages.

75. The efficacy of *strict seclusion* was demonstrated by some striking instances during the prevalence of the distemper in Malta. The Augustine Convent stands near the top of one of the main streets of Valetta. When the plague appeared, the strictest precautions were used to prevent all communications with the town; but a servant went into a part of the town where it prevailed, and purchased clothes supposed to he infected. Soon after his return he confessed what he had done; he was immediately shut up, with one of the brotherhood who volunteered to attend him. Both of them were seized and died of the distemper, but no other person in the convent suffered. "When the plague was in Malta in 1675, Cavallino, who described it, states that all public establishments which cautiously shunned intercourse with the community, enjoyed perfect exemption from the disease; as did the prisons and monasteries, besides all the vessels in the harhour. In the late plague it was the same; the hospital of St. John of Jerusalem, the prison, and several public offices, and private houses, which early adopted, and steadily kept up, a rigid system of insulation, were not less fortunate."

76. A large building in Valetta had its ground floor divided into seven separate apartments, occupied by as many Maltese families; and its upper stories used as a military hospital for patients affected with common diseases. During the plague of 1813 the ground floor was penetrated by it; the inhabitants of four of these apartments were destroyed by it, and two only of each family escaped in the other three. While this was going on below, the sick tenants of the upper stories were shut in, all communication was cut off, and every individual among them escaped the pestilence, although it was raging in the houses around, and penetrating from the lower to the upper stories. Dr. Greaves, whose house was within a few feet of this hospital, related this fact to Dr. M'Lean, at Valetta, and led him over the hospital, hut no mention is made of it hy this uncandid writer and ignorant physician. I say this from personal knowledge.

77. The anti-infectionists contend that the plague of Malta was not introduced by the ship which arrived from Alexandria very shortly before its outbreak, but from "a noxious state of the air;" and it has been shown, at other places, that they attribute the choleric and hæmagastric pestilences also to noxious states of the air; but how is it that this noxious air, which plays so important a part in the production of plague according to them, did not produce one of the other pestilences? We have seen that these three several forms of pestilence have ravaged the same places at different times; and, taking it for granted that they all arise from "a noxious state of the air," as the anti-infectionists would have us to believe, in what does the noxious air producing the one pestilence differ from that producing the others? It has now been shown by numerous proofs, and many more may be, and some will be, farther adduced, that, while the distemper was depopulating numerous houses and streets, other houses and institutions, completely surrounded by these houses and streets, remained entirely uninfected, by observing the strictest separation. If the mischief was solely in the air, how came these isolated places to escape, not only during the prevalence of plague, hut also during the prevalence of the other two pestilences, as shown in the appropriate places? And, moreover, how came "the noxious state of the air," causing the plague of Malta, after 137 years, the plague of Moscow, after 150 years, and the plague of Marseilles, after 70 years, to occur at such distant periods, and no indications of its existence in the intervals to have appeared? And how can the anti-infectionists prove this "noxious state of the air," this undefined, this supposititious, this airy, this baseless entity or non-entity, and account for the wonderful reappearance of it, after so very many years, just at the moment most desired to serve as an argument against the introduction of the plague by an infected vessel? And, again, from whence came the "noxious state of the air," which, according to the anti-infectionists, produced the choleric pestilence, and which had never previously existed, inasmuch as its imputed effects, this particular distemper, was not known to have ever appeared before 1817?

78. Dr. Mackenzie resided at Constantinople and Smyrna for about twenty years, in the middle of the last century; and during that period scarcely a year passed without some appearance of the plague in one or both of these cities. He communicated his observations on the distemper to Dr. Mead and Dr. Clephane, which were published in the forty-seventh volume of the "Philosophical Transactions." The plague raged with great violence at Constantinople in 1751, and destroyed about 150,000 persons; and Dr. Mackenzie, who was then residing in this city, remarked respecting it, that "he could see no other apparent cause of the virulence of the disease this year, besides the occasion of greater communication. In the months of February, March, April, and May last, the distemper was so strong at Cairo, as appears by letters from the English consul there, that no doors were opened for three months. In the mean time there arrived here, in May last, four ships laden with Cairo goods, which goods and men being landed, spread the infection over all the city at once, after which one conveyed it to another by contact. In the village where we lived there died only sixty persons of the plague. The French ambassador's palace, next door to us in the village, was infected, because five of his people went at midnight to a bawdy-house, where the father Demetry, the mother, and daughter had the plague, and died of it afterward, all three; so that two of his excellency's servants were infected hy them, one of whom died, and the other recovered and is still living, after taking a vomit, some doses of the bark mixed with snake-root and Venice treacle, by my advice. We found this last time, and upon all such occasions, that whoever kept their door shut ran

no risk, even if the plague were in the next house; and the contact was easily traced in all the accidents which happened among the Franks."

79. Samolowitz, who had extensive experience of the plague in Poland, Moldavia, Wallachia, and, lastly, in the epidemic of Moscow, states that it is certain that this distemper is propagated by contact; and Orræus, who was sent by the Empress Catharine of Russia to advise during the plagues at Yassy and Moscow, remarks that the most common mode of contracting the disease was by contact. When Mr. Howard went, in 1785, to visit the chief lazarettoes in France and Italy, he carried with him a set of questions concerning the plague, drawn up by Dr. Aiken and Dr. Jebb, which were to be submitted to the most experienced practitioners in the places which he visited. On his return, Dr. Aiken methodized and abridged the answers, and the result is given in the celebrated work on the Lazarettoes of Europe. "They all," says Mr. Howard, "in the most explicit manner, concur in representing the plague as a contagious disease, communicated by near approach to, or actual contact with, infected persons or things."

80. During the war, at the end of the last and commencement of the present century, the medical officers of both the French and English armies had numerous occasions of observing the plague, and they almost unanimously concluded that it was a contagious disease. Even Dr. Bancroft, who strenuously contended against the infectious nature of the hæmagastric pestilence, and who was present with the English army during a part of the Egyptian campaign, states that "the facts which prove the necessity of actual contact with some infected person or thing to communicate the plague, are so numerous, and many of them so notorious, that it must be unnecessary for me to enter upon a detail of them, after what Dr. Russell and others have published, and after the experience of the British army in Egypt, which invariably demonstrated this necessity, by showing that all those who avoided contact invariably escaped the disease, while those who did otherwise in suitable conditions, were very generally infected. Nor was there, so far as I have been able to discover, any instance, in the French-Egyptian army, of a communication of the disease without contact, though the physicians to that army who have written on the subject do not, I believe, positively assert the impossibility of such communication."

81. Sir James M'Grigor, physician to the Indian army in Egypt during the Egyptian campaign, in his medical sketches of that expedition, gives the following account of the arrangements at the pest-houses, and their results: "In the pest-houses of the army thirteen medical gentlemen did duty, who in the Indian army might be said to have had the post of honour. In order to take from our medical gentlemen, in the pest-houses, some of the most dangerous part of the duty, it was my wish to procure some of the Greek doctors of the country to reside in the pest-houses, to feel the pulses there, draw blood, open and dress buboes, &c. The most diligent search was made for those people, and very high pay was promised to them, but we could tempt none of them to live in our pest-houses: a plain proof of the opinion which they entertain of the contagious nature of the disease. The thirteen gentlemen first mentioned were those only that were directly in the way of contagion, for it became their duty to come in contact with the infected, and seven of them caught the infection, and four died. To the atmosphere of the disease all the medical gentlemen of the army were exposed, as they saw and examined the cases in the first instance; but, except from actual contact, there never appeared to be any danger."

82. The medical officers of the French army came to similar conclusions. Desgenettes, in his *Histoire Médicale de l'Armée d'Orient*, thus sums up his opinion on the subject of the plague: "The plague is evidently contagious, but the conditions of the transmission of this contagion are not more exactly known than its specific nature. The dead body has not appeared to transmit it—the animal body in a heated state, and still more in a state of febrile moisture, has appeared to communicate it more easily; the contagion has been known to cease in passing from one river to another of the Nile; a simple trench made before a camp has been known to stop its ravages; and on observations of this kind is founded the useful insulation of the Franks, the practice of which has been sufficiently detailed by different travellers."

83. Baron Larrey states a similar opinion: "But however strong may have been these affections (moral), their effects cannot be compared to those which resulted from the communication of the healthy with the sick, or to the effects of contact with contaminated objects. We may be convinced of this truth by the ravages which the plague made in the year 9 (1801) among the Fatalist Mussulmans. It were to be wished that, on the first days of the invasion of the plague, its true character had been presented to the army. This would have diminished the number of victims; instead of which the soldier, imbued with the opinion which was at first propagated, that this disease was not pestilential, did not hesitate to seize and wear the effects of his companions dead of the plague. The pestilential germ developed itself in these individuals, who often sunk under the same fate. It was only when they had gained a perfect knowledge of this disease, that many preserved themselves by the precautions which were indicated."

84. Dr. Sotira, another of the physicians of the French army in Egypt, relates the following striking circumstance: "In the seventh year of the French republic about eighty medical officers died of the plague. In consequence of this mortality, an order was issued to employ Turkish barbers in the pest-houses, to dress the patients, and to undertake all the medical treatment which required actual contact. The result was, that during the next two years only twelve of the medical officers died of the plague; but half the Turkish barbers caught it." I now arrive at

85. *B. The Opinions of contemporary Writers as to the Infectious Nature of the Plague.—a.* The French government, with the view of causing an alteration of the quarantine laws, lately referred the consideration of the communicability of this pestilence to the Royal Academy of

Paris; and this body appointed a commission to inquire into the matter. This commission has published its report, and with it numerous documents from medical men who have served in Egypt and Syria during the last twenty or twenty-five years. Certain of these documents are answers to questions which were sent to the British consul in Egypt by the foreign minister; and others are essays on the subjects in question by various medical men attached to the army and civil establishment of the governor of that country. From these the Academy has drawn up its report; which, however, is of much less importance and interest than the papers on which it is founded. The opinions conveyed in all these papers agree as to the communicability of this distemper from person to person; they differ merely as to the modes of communication and the circumstances favouring and preventing infection.* It is thus stated by the reporters that nearly all the physicians in Egypt (there are considerably upward of a hundred French and Italian physicians in this country) believe in the transmission of the plague by means of the emanations proceeding from the bodies of plague patients; and that Dr. Grassi, physician to the lazaretto at Alexandria, alone espouses the doctrine of the communication of the distemper by immediate or mediate contact only, and without the interposing medium of the air; and they add that the Egyptian physicians consider that a prolonged stay in the chambers of those affected is particularly dangerous, and the more so the more that ventilation is neglected.

86. Dr. Grassi, who has written a long memoir on the dissemination of the plague, has had an experience of twenty-nine years in Egypt and Syria, during which time his opportunities of observing this pestilence, especially as physician to the lazaretto, have been great beyond all others. He adduces numerous proofs in support of his opinion; but Dr. Clot-bey and some others contend, in opposition to him, that they would not have taken place, or, in other words, the same results would not have followed the circumstances adduced, if observed at other periods, or in other places, than those of epidemic influence. The facts are so numerous and so well authenticated of the communication of the distemper, that they cannot be denied; but those who espouse the doctrine of conditional infection, as many of the Egypto-European physicians appear to do, contend that the infectious property exists only in respect of the epidemic, and not of the sporadic or endemic malady; and that if the epidemic influence did not exist, no infection would take place. According to this view, the distemper cannot spread by infection without the epidemic circle; and when the infection is conveyed to a distance by persons or clothes, it cannot propagate itself unless there be existing at the time and place an epidemic influence

* It should be kept in recollection that French writers limit the term *contagion* to the communication of a disease from the sick to the healthy by immediate contact, and that they apply the term *infection* to the transmission of disease by miasms proceeding from the sick, and contaminating the air respired by the healthy. In many of the writings of French pathologists, "*Foyers Epidemiques*," epidemic foci, influences or centres, play a very prominent part; and, according to many, no infectious disease can extend without this epidemic centre or influence be present. Some even suppose that the epidemic influence is itself the infecting agent; and they, with many others, argue that this influence, as well as all emanations from the soil, from matters decaying or putrefying in or on the surface of the earth, and from the bodies of the sick, are severally *infectants*, without, however, distinguishing between each, and confining, as British pathologists have uniformly, the word *infection* to the spreading of a disease from the sick to the healthy by means of emanations proceeding from the former, and producing and perpetuating in the latter the same disease, possessing the same property of disseminating and perpetuating itself. In this report of the Academy, as well as in some of the papers on which it is based, the "*foyer epidemique*" has a most prominent place assigned to it. If a case of plague occurs without spreading to others—if the several circumstances preventing the extension of the distemper be present or are observed—if a free ventilation of the sick, or of their effects, &c., be enforced—if the sick be not approached, and other means of prevention be observed—if those communicating with the infected be protected by a previous attack of the distemper—if the air be pure, dry, very cold, or very hot—if, in short, the circumstances favouring the extension of the malady are not present, then the occasional appearance of it (as in the instance of smallpox occurring in solitary cases when it is not epidemic) is said to be sporadic or endemic: but when various filiations of the distemper are traced from the person or persons first infected, to various streets, or to distant parts of a town—when a person becomes infected in a particular house, and the attendants or friends from different parts have left him, and convey the distemper to their homes and to their attendants, and these latter to others, then, according to the reporters of the Academy and many of the French-Egyptian physicians, a "*foyer epidemique*" is kindled, and is breaking out in various places. A poor devil of the rational school of physic may have some idea of the manner in which a humid, still air, close apartments and streets, imperfect ventilation, &c., favour the concentration of an animal effluvium proceeding from the sick, and its operation on the healthy, as well as heighten the predisposition of the latter to be infected. He even admits that these conditions may so alter the electro-motive states not only of the air, but also of animal bodies, and of other objects placed on the earth's surface, at the particular places where they occur, as thereby to heighten the effects otherwise produced by them. But the "foyer epidemique" is beyond his comprehension, unless it means something resembling what I have now endeavoured to explain. If it is anything else, it is only a term employed to conceal an ignorance which would have been better candidly confessed. One thing cannot be disputed, and this is, that the "foyer epidemique" plays a very harlequin part; it is here, there, and everywhere, but not at the same time, at least at first. It exists in a given circumference, and not in the centre; or in certain radii, and neither at the centre nor at the circumference; and yet it admits not of recognition but by its effects. It is the supposed source of plague, of pestilential cholera, and of pestilential yellow fever—these three great pestilences being very generally attributed to this cause by our neighbours. Now, as there are three pestilences, there must necessarily be, according to this view, also three different "foyers epidemiques;" for each specific malady must have a specific "foyer" for its source. Without, however, inquiring into the origin and nature of these "*foyers*"—for such inquiry is never thought of by them, it being quite sufficient to assume their existence—it must be inferred that they are most unaccountable things, seeing that they possess neither length, breadth, nor thickness, nor other material characteristics, and yet produce material effects; that they are neither recognised nor recognisable, and yet they destroy large portions of the human race; that their existence is a hypothesis, a supposition, and yet they produce ruin and devastation; that their hypothetical presence is only for a few weeks or months, and then, after many hundreds of years, never again to return, or then after short intervals, according to the manner of their reception. How very odd is their occurrence! In one year there was a "foyer epidemique," viz., that of pestilential cholera, which visited the countries of the Levant, and, among very many other places, Paris in particular, where the doctrine of "foyers" is so much in vogue; yet, in the following two years another "foyer epidemique," namely, that of plague, followed the one of pestilential cholera, the latter emulating the former in its destructive powers, as if enraged at the usurpation of a "foyer" never before known. Believing that there are certain conditions of the atmosphere favouring more or less the spread of infectious diseases, on the one hand, and restraining it on the other, I cannot subscribe to the all-efficient and absorbing "*foyers epidemiques*" of our neighbours, nor attempt to shelter my ignorance by a constant recurrence to a term which either means something appreciable and determinate, as in the light in which I would view it; or which is anything or nothing as it may suit an hypothesis, subserve a purpose, conceal a sophism, or mask a design.

favourable to this effect. In what this influence consists is not shown. It is not admitted to be merely a humid, stagnant, or impure air, as this state of the atmosphere is frequently observed without the distemper becoming prevalent; it is, therefore, believed by the supporters of this doctrine, that there must be some other superadded property, constituting, with or without the other properties of humidity, stillness, and a certain range of temperature, the epidemic influence in question; and that it is developed generally after lengthened intervals, or after terms of ten, fifteen, or twenty years, the terms being of different durations in different countries. In tracing the filiations of this influence according to these writers, numerous and singular vagaries are usually observed, especially as respects its attachment to certain persons and places, and its aversion to others. These filiations proceed sometimes in a hop, step, and jump manner, and straight ahead; then zigzag; now circuitously, next centrically, afterward eccentrically; but in whatever way they shoot forth, they show a remarkable respect for certain places and persons, more particularly for those who shut them out or who keep out of their way. Now, instead of attributing, with the abettors of the all-sufficiency of epidemic influence, the oddities so remarkable in the spread of this pestilence, to this influence solely, I consider that, when viewed in a proper light, there are neither vagaries nor oddities to be recognised; but merely the communication of the infection from person to person, favoured by proximity, and a temperate, humid, and still condition of the atmosphere; and that places and persons are exempted from it, according as the former may shut it out, or be out of its way; as it is conveyed in the person or in the clothes worn by the infected, or as the latter may be protected by a former attack, or be but little susceptible of the infection.

87. Much of the skepticism which has recently appeared in the East as to the infectious nature of this pestilence is to be attributed to the preconceived ideas entertained by the young French and Italian surgeons and physicians who have entered into the service of the Pacha of Egypt, and who have thought it a most distinguished feat to brave the dangers, as well as to oppose the doctrine, of contagion and infection. The experienced Dr. Grassi states, with reference to this fact, that the champions of non-contagion disseminated an error which soon brought destruction on themselves and on many who had communication with them; that, in 1843—a year in which the distemper does not appear to have been very prevalent, unless in Cairo—numerous instances of contagion were furnished in some of the provinces of Lower Egypt, of which he adduces a few, showing the consequences of a disbelief in this property, on the part of those who ought to have known the truth, and to have acted accordingly; that, owing to this cause, the plague was introduced into several regiments, the surgeons of which were anti-contagionists; and that those surgeons, and many of those committed to their care, were thereby sacrificed. Dr. Mareschi, he adds, physician to the 5th regiment, fell ill and died at Mansour. He was attended by Dr. Certani, of the 3d regiment, and the plague commenced in both regiments. The apothecary became infected, and died. Dr. Certani persisted in denying the infectious nature of the distemper, and purchased the carpet used by an officer in his regiment who had died of it. He slept on this carpet, but he never again arose from it. Dr. Bouteille, of the 4th cavalry, attended Dr. Certani, the apothecary, and his wife, who had all died of the plague, was congratulating himself on his escape, when he was attacked and died. Dr. Valencogne, who had succeeded Dr. Mareschi at Mansour, and who was also a non-contagionist, having acquired some things which belonged to, and had been used by, Dr. Bouteille, would not attend to the recommendation of purifying them before using them, and he fell a victim to his incredulity. Dr. Rossi, of the 7th regiment, was attacked by the distemper and recovered. This young physician, two years before, had written a memoir against the infectious nature of the plague; but he afterward changed his opinion. Four apothecaries, of whom three died, and most of their families, in all twenty-three Europeans, nearly all those living in the province, were thus sacrificed.

88. Numerous other instances of the communicability and importation of this pestilence have been adduced by Dr. Grassi, from his own observations in Egypt, Syria, and Palestine. My limits admit not of a farther notice of them; but they may be found in the Report of the French Academy of Medicine. He concludes as follows: 1st. That the plague is a disease entirely *sui generis*, possessing characters which are proper to it, and which distinguish it from all other maladies. 2d. That it is transmissible and transportable, and consequently eminently contagious. 3d. That its origin, like that of some other contagious diseases, is unknown; that it is not reproduced *de novo*; but that its seminium is preserved in one or other province or provinces of Turkey —sometimes in one, at another time in another. 4th. That, like smallpox, it very rarely attacks those persons who have been previously infected by it; and if it does, the attack is slight. 5th. That it prevails chiefly in temperate climates. And, 6th. That if it were combated and restrained in all directions, it might be ultimately suppressed, if the ignorance and fanaticism of some people would not oppose the attempt.

89. M. Lachèze states (*Rapp. de l'Acad.*, &c., p. 567) that he arrived in Alexandria during the prevalence of the plague there in 1834, and that he proceeded soon afterward to Cairo, where the distemper broke out on the 2d of February, 1835, and became remarkably destructive. Méhémet Ali shut himself up in the palace of Schoubra, with 300 persons composing his suite, and surrounded it with a double cordon of troops. Three persons only were seized with the early symptoms of plague, and they were instantly dismissed. Captain Varin, who commanded the School of Cavalry, informed Dr. Lachèze that 515 persons composing it were subjected to strict seclusion under his orders; that during their seclusion they enjoyed the same diet, regimen, and exercises as before; and that in the four months during which the quarantine lasted no case of serious

disease, and none of plague, occurred among them. Captain Varin adds, that the town of Gizeh, in the midst of which the School of Cavalry was placed in quarantine, experienced a greater mortality in proportion to its population than even Cairo, in which one third of the inhabitants died, and yet strict seclusion in that town was followed by the most complete protection. Surely, if the disease was so entirely dependant upon epidemic influence, as contended for hy the anti-infectionists, it should have appeared among the persons secluded in this instance, seeing that they were surrounded by this, to their minds, all-powerful influence.

90. M. de Segur Dupeyron, secretary to the Superior Council of Health (*Rapp. de l'Acad.*, &c., p. 593), states that during his several missions he has visited nearly all the places in the East and in Africa where the plague has appeared, with the view of determining its origin in those places; that his researches have proved that this distemper has generally appeared in consequence of scarcity following too great or too low a rise of the Nile; that the occurrence of this pestilence in Europe, especially in Venice, Trieste, Livournia, Genoa, and Marseilles, before the formation of quarantines, was frequent, and always connected with the prevalence of it in the Levant, especially during peace, when communication was unrestricted and frequent; that from 1721 until 1830 the plague has been imported thirty-three times into these ports by means of vessels which have been detained in quarantine; and that of these thirty-three importations eighteen came from Egypt; that this distemper was not constant in Constantinople until after the conquest of it by the Turks, when it became frequent, and at last almost permanent, owing to the return of numerous pilgrims from Mecca in vessels which, with the pilgrims themselves, were often infected; that he has seen the pilgrims arrive in small, crowded vessels, in a frightful state of dirt and disease; but that the plague has scarcely appeared in Constantinople since 1837, when quarantine and sanitary establishments were formed in that city; and that the plague is endemic in Egypt; but that it is not endemic, although frequent, in Syria, Constantinople, and Barbary. M. Segur concludes with some apposite remarks on its contagious nature, in which he firmly believes, hoth from his own observation and the evidence of others. He considers that this pestilence will never he arrested in its progress unless it be rigorously treated as contagious, until it has destroyed all those susceptible of infection, or until the temperature and state of the atmosphere become unfavourable to its farther extension; and he refers to the very decided measures adopted by General Maitland, who on four different occasions—in Malta, Gozzo, Corfu, and Cephalonia—put a stop to the distemper by a strict system of separation and seclusion. M. Segur adduces numerous instances of passengers and other persons detained in quarantine in various ports, who were seized with the plague on opening their trunks and exposing their clothes to the air, the distemper extending to one or more of the health-guards. One or two of these instances is sufficient for my argument. In July, 1832, some passengers from Constantinople and Scio, where the plague was prevailing, were landed at the Lazaret of Syra. On the sixth day after their entrance they opened their baggage, and eight of them were soon afterward attacked, and six of them died.

91. A Greek vessel arrived at the lazaret at Venice, in 1793, from Syria and Napoli de Romana. This vessel received on board, in Syria, a supply of five sailors. Four of them left the ship in the Morea, where they brought the contagion. One only, named Apostoli, remained when she arrived in quarantine. After unloading the cargo, which was not considered capable of conveying contagion, the sailors opened their chests and changed their clothes. Apostoli was first attacked. Twenty-one were infected, and sixteen died in the lazaret. Of the health-guards, eight were attacked and three died. In 1818 the plague appeared in the same lazaret, on hoard of a ship which had only two days to complete the quarantine. A passenger, who had not opened his trunk until then, was soon afterward seized, and died in two days. His health-guard was next attacked, and also died.

92. Dr. Morpurgo (*Rapp. à l'Acad.*, p. 609) resided eight years in Egypt, Syria, and Turkey, and was charged, in 1829, to organize the central hospital in Cairo by the pacha. In April, 1831, he quitted Alexandria and went to Constantinople. On his arrival there were no cases of plague in the city; but cholera prevailed. Subsequently a Greek vessel arrived from Cyprus with the plague, and the distemper soon afterward appeared in the Greek quarter of the city. Dr. Morpurgo left Constantinople, and arrived at Smyrna in April, 1832. The plague had not appeared there for several years, hut the pestilential cholera had made great ravages. Soon after his arrival in Smyrna he was charged by the European inhabitants to organize a house of refuge for the poor of all nations and of all religions, and was brought in constant communication with the poorer classes. But until the month of May, 1833, he did not meet with a single case of plague; proving that this malady is not endemic in this port. During the five years that he passed in Smyrna he observed four epidemics of the plague. The first appeared in May, 1833. The distemper was introduced by a vessel whose crew and passengers were landed and placed under tents while the process of purifying the vessel was proceeding. Dr. Morpurgo traces the several filiations of the infection until the cases became numerous. It would appear from his details that, during the winter months of 1834, 1835, and 1836, the distemper lurked in this city, appearing during the spring, and becoming more and more prevalent until the spring of 1837, when it became very fatal, and many of the wealthier inhabitants either fled from the city or placed themselves in strict seclusion. During this most severe epidemic the plague made the earliest and greatest ravages in the most airy and cleanest quarter, and the latest and the least in the closest, the most dirty, and the most miserable district. During these epidemics, or, rather, epidemic—for the disease was introduced and continued for four years, slumbering for certain periods, and breaking out and prevailing more or less during others, according to circumstances, which will be

explained in the sequel—several occurrences were remarked by Dr. Morpurgo deserving notice. A Dr. Justiniani, of the Faculty of Paris, arrived at Smyrna, and saw neither contagion nor infection in the plague, or nothing else than a gastro-enterite. He was soon afterward attacked, and died in three days. The Prussian consul shut himself up with his family, and had recourse to the strictest precautions; nevertheless, a chambermaid was attacked, and confessed, when near her end, that she had received through a window linen from her lover to wash, who lived in an infected quarter, a circumstance proving the difficulty of preserving a strict seclusion in cases even of the most imminent risk. In the most unhealthy locality of the city, where several drains and sewers meander through margins of filth, a barrack is situated containing from 1200 to 1300 troops. The physician advised the colonel to adopt the most rigid quarantine, and it was strictly observed. Not an individual was attacked, although the distemper was raging around them; and during their seclusion they had the same food and rations as before and after. All the convents which observed seclusion were completely protected, as also was the college, although situated in an unhealthy locality. The Greek and Catholic sick, not infected by the plague, were received into the same hospital with plague cases, but in different wards; none of them caught the distemper, a circumstance which Dr. Morpurgo considers a strong proof of the spread of the malady by contagion, and not by infection. He concludes his communications to the Academy by stating his conviction that the plague is not peculiar to any particular locality; that it is propagated by a seminium or germ, distinct from any other, and resembling those of syphilis and smallpox; that it always proceeds from and perpetuates the same distemper; that the isolation of the sick is the only protection; and that three things are necessary to the spread of the pestilence; namely, its seminium or germ, a favourable state of the atmosphere, and susceptibility of infection.

93. Among the most experienced physicians who have communicated to the Academy the results of their observations, Dr. Gaetani may be adduced. He is first physician to the viceroy, and has resided many years in Egypt. He states (*Rapp. à l'Acad.*, p. 627) that from 1825 until 1834 he met with no case of plague in Egypt; but that since 1834 this pestilence has appeared in a great number of towns and villages of Lower Egypt, and has occurred in many of these places during the months of September, October, and November, generally sporadically or in isolated cases; that it becomes epidemic in January and February, and subsides in June; and that he has not met with the distemper in Upper Egypt, but that during the epidemic of 1835 several cases arrived at Syouth, Fayoum, Cosseir, and other towns in Upper Egypt, without propagating the malady. During the epidemic of 1835, he states that more than fifty of the principal families of Cairo put themselves in quarantine, either at the desire of the viceroy, or from their own conviction of its necessity, and that not a case of the plague occurred in more than three or four of these families. When a case appeared in a house placed in quarantine, it was always found that some suspicious circumstance or communication had taken place. In the palace of Scherib-pacha two compartments existed, one for the men, the other for the women. In that for the men, who communicated with the city, many cases occurred, but in that of the women, which was strictly secluded, not a case was seen. At the commencement of the epidemic in Cairo, this city had a garrison of 22,000 troops, independently of 2000 invalids. These last alone were left to guard the city, and the troops were placed under tents, in an intrenched camp; and, although this camp was only a quarter of a league from the city, the plague did not appear among them; while it carried off one half of the invalids who remained in the city.

94. Dr. Gaetani adduces, in proof of the transmission of the pestilence by clothes, the fact that there existed at Rosetta a magazine of effects belonging to plague patients. This magazine was opened after two years, and three persons were seized with the distemper, although the town was in a most salubrious state, but they did not communicate the malady to others. He believes that the effects of plague patients will convey to a distance the malady, when the circumstances favouring infection are present; that the beds, bed-clothes, and body-clothes of the infected are most to be dreaded; and that merchandise never or very rarely transmits the disease. He also thinks that the pestilential miasms, during the prevalence of the malady, in a close, low, wet, and thickly-populated locality, may accumulate in the humid and still air to such an extent as to transmit the distemper without any nearer or personal communication; and that it is to this contamination of the air, by the effluvia of the sick, that the extension of the pestilence to houses in which strict seclusion had been observed is to be attributed; for the state of the locality, the narrowness of the streets, and the circumstances just stated, in all such instances, could sufficiently account for the occurrence, without referring it to clandestine intercourse.

95. I believe that I have now adduced sufficient evidence of the infectious nature of the plague—infectious by direct or mediate contact, or by a humid air, conveying the pestilential miasms. I might have adduced ten times more evidence of the matter; but my limits will not permit me to do that which will appear to all candid minds as altogether unnecessary. There are, however, certain topics connected with the subject that yet require farther notice, in order to complete the full consideration due to it.

96. *C. The propagation of this distemper by inoculation* has been believed by some to be an important and necessary part of the evidence of the contagious nature imputed to it. But this proof is neither necessary to the completeness of the evidence required, nor is it of importance in this or in any other respect. There is almost no other febrile disease, besides smallpox and cowpox, that admits of certain communication by inoculation. All other infectious maladies have presented only a few contingent and doubtful instances of infection by this method. As respects smallpox, cowpox,

and some chronic contagious maladies, we observe a specific contagious virus or secretion formed at an advanced stage of the malady, capable of propagating it, unless in those very dry states of the air which is unfavourable to the propagation of all infectious and contagious maladies, when it frequently, also, fails of imparting the disease. If other secretions, or the blood itself, of a smallpox patient be used for inoculation, no more certain results would follow than those which have been observed to follow the employment of these fluids in attempting to inoculate the plague, scarlet fever, or typhus fever, or the measles. In the case of the plague, there is no consistent or specific virus or secretion proper to and characteristic of the distemper, that may be employed in this way with any rational hopes of its perpetuating the disease. The ichor or discharge from a carbuncle is merely contingent upon a local accident of the malady; the purulent matter from a bubo is equally such, and is chiefly met with during an early period of amendment; the blood of the infected can no more be expected to transmit the distemper than the blood in any other infectious disease, which has repeatedly been found to fail. Even granting it possible to procure the pestilential miasm, seminium, or matter of the plague, the difficulty would still exist as to the application of it to the frame of the healthy in that state, and to that particular organ and tissue by which its effects would be most certainly developed. I shall have in the sequel to infer, from the great mass of evidence I have perused, a part only of which I have here adduced, that it is chiefly owing to the pestilential miasms or effluvia proceeding either directly from the diseased, or preserved in their bed or body clothes, and given off upon their first exposure to the air, and inspired by susceptible persons, that the distemper is propagated and perpetuated. A near approach, amounting almost to contact, sometimes accompanied with contact, is often necessary to this effect; contact merely will often fail, or, rather, it will succeed in communicating the malady only when it is attended by the inhalation of the effluvium or pestilential miasm, whether proceeding from the diseased body or from fomites. Now how can the same effect be produced by the inoculation of fluids which have not been proved to possess the property of perpetuating the distemper, which, reasoning *à priori*, cannot be supposed to possess this property, and which, even granting them the possession of it, cannot be conveyed to that channel through which the observing mind must admit the infection to be principally, if not solely, admitted and transmitted through the economy?

97. From this it may be admitted that attempts at inoculation must be nugatory in respect of this pestilence, as well as of the two pestilences already considered; or if any attempts to inoculate succeed, their success is liable to be imputed, as it actually has been by the anti-infectionists, to the operation of the epidemic influence, and in no way to the inoculation, the persons infected being attacked altogether in consequence of this constitution of the air, and independently of any pestilential miasm, seminium or effluvium, proceeding from the diseased and inhaled with the air by the healthy, for the existence of which seminium I, in common with other infectionists, contend. If attempts at inoculation should frequently prove futile, it must be obvious, from our knowledge of the operations of the digestive organs, that the experiments made by certain nasty fellows, in the excess of their scientific enthusiasm, in order to show the non-contagious nature of this and the other two pestilences, by swallowing the secretions and discharges of persons labouring under these distempers, must necessarily prove still more futile, insomuch as no effects beyond nausea or vomiting could be expected from these experiments. Indeed, it is most probable that the extent of the probable or possible mischief was clearly seen, and safely, as well as most courageously, attempted by these experimenters.

98. However, the attempts at inoculation which have been made require a still more particular notice. M. Desgenettes, finding the French troops in Egypt much depressed by their dread of the plague, attempted to inoculate himself with the distemper; but, to secure himself from risk, he afterward washed the part with soap and water; and, according to his own statement, he not only used this precaution, but he employed "the pus of a bubo of a convalescent patient"—using, in fact, the matter of what had become a healthy suppurating sore. Soon afterward, Dr. Whyte, an anti-contagionist, in the English army, hearing of this feat, but not of the precautions which had been taken, repeated the experiment in a much more efficient and dangerous manner. "He rubbed some matter, from the bubo of a woman, on the insides of his thighs. The next morning he inoculated himself in the wrists with matter taken from a running bubo of a sepoy." This was done on the 2d and 3d of January, 1802, and on the 6th he was attacked with rigours and other febrile symptoms, succeeded by heat and perspiration, much affection of the head, tremour of the limbs, a dry, black tongue, great thirst, a full, hard, irregular pulse, great debility and anxiety. He still persisted that the disease was not the plague, and would not allow his groins and armpits to be examined. He became delirious on the 8th, and died on the 9th.

99. Dr. Gooch, in his paper on the contagion of the plague, has stated that Dr. Valli, an Italian physician who resided some time in Turkey, made some experiments on the inoculation of the plague. He diluted the pestilential matter with smallpox matter, with oil, &c. This compound he called his pommade. If a Mussulman came to consult him for an ophthalmia, he ordered him some of his pommade to rub on his eyelids; if another came, complaining of pain in the bowels, he ordered it to be rubbed on his belly. In this murderous way he gave, it is said, the distemper to thirty persons. The Turkish government at last arrested the pharmacopolist who vended the pommade, and cut off his head, but Dr. Valli escaped.

100. Dr. L. Delaporte states, in a memoir addressed to the Royal Academy of Medicine in Paris (*Rapp à l'Acad.*, &c., p. 321), that Dr. Gaetani-Bey communicated to him the fact that a person in Cairo, having persuaded several of his acquaintances that he would protect them from any future attack of the plague by

inoculating them with the sanies taken from a person recently dead of the distemper, found no less than eleven who, with himself, submitted to the experiment. They, however, were all attacked, and died, the experimenter himself only escaping; but he was not altogether recovered when Dr. Gaetani saw him.

101. It might he supposed that these experiments are tolerably decisive, not only of the contagious nature of the distemper, but also of the great probability of the communication of it, in its most deadly form, by inoculation. Yet the anti-contagionists will, nevertheless, contend that the individuals thus inoculated and killed by the experiment were actually not inoculated with the distemper, but were all attacked by the epidemic influence, which alone produced the disease of which they died! This mode of accounting for the result in no less than twelve instances, although admitted to have occurred at a time when the distemper was prevalent, shows the shifts to which the supporters of this doctrine resort to evade a most conclusive piece of evidence, happily furnished by a most respectable physician, although the experiments were as happily not performed by a medical practitioner. Now, the supporters of the all-powerful epidemic influence in the propagation of this distemper allow, that in Egypt the plague is epidemic only from February to the end of June; and as Dr. Whyte's inoculation of himself (§ 98) was performed on the 2d of January, his infection in consequence, therefore, could not be imputed to this influence—for it had not then commenced—but to its right cause, the inoculation. Now, seeing the disease actually follows inoculation in some instances (of which I have adduced only a very few out of the many which I have seen recorded), although it fails in others, and may be expected to fail for the reasons stated when commencing the consideration of the topic, there is nothing that can be reasonably desired farther to prove the *contagious*, as well as the *infectious nature* of this pestilence, according to the meaning which I have fully and explicitly applied to these terms at the setting out (§ 58, 59).

102. The immense importance of the various topics connected with the contagious nature of plague will not admit of my relinquishing the consideration of this part of the subject without noticing certain of the conclusions at which the commission of the French Academy of Medicine has arrived. The necessity of making some alterations in the quarantine laws, without endangering the safety of the community, especially during the now more frequent and more rapid communications between the several ports in the Levant and the south of France, induced the French government to refer the subject to the Academy, who appointed a commission, whose report is now before me. It is most likely that much of this report will he used by the anti-infectionists in support of their arguments, not so much for the facts and evidence which may appear to favour their views, but for the use of terms to which this commission has attached a different meaning to that which is applied to these terms in this country. In noticing, therefore, somewhat farther certain topics connected with the *origin* and *propagation of the plague*, I shall make some remarks upon this laboured, but not very perfect performance.

103. *D. Of the origin of plague*, nothing can be asserted with any degree of certainty. The earliest indications of its existence have been already noticed, and its antiquity shown (§ 4); but whether or not it has always been, from the remotest period of its existence, propagated by a certain germ or seminium, *sui generis*, conveyed from one part to others, more or less distant, by persons or clothes, preserved in some one or other of the countries of the Levant, prevailing in some places, then subsiding, sometimes smouldering on with few or scattered cases, at other times breaking out into more open combustion as circumstances fanned the fire; or whether it has been produced, *de novo*, on several or many occasions, and whenever various local circumstances have arisen to generate it, are questions which have not hitherto been solved, although severally entertained by numerous observing and experienced physicians. The proposition involved in the first alternative has received considerable support from the investigations of Dr. Russell in Syria, who completely established the fact that a *second attack* of plague, among the thousands of cases comprised by his researches, is of much rarer occurrence than a second attack of smallpox. Having established this most important fact, which subsequent researches have fully confirmed, but which the commission has entirely disregarded and never mentioned, a very convincing proof is thereby furnished of the contagious nature of the distemper, as well as a strong presumption of the truth of that proposition; the plague thus appearing in the same category with smallpox, hæmagastric pestilence, &c., and the same arguments which were employed when discussing this question in respect to that pestilence being equally applicable to this. (*See* Pestilence—Hæmagastric, § 125, *et seq.*)

104. *a. The protection furnished by a first attack* being thus established, with but very few exceptions, it must be obvious to the candid inquirer that numerous occasions will occur, in the countries of the Levant, in which a very large proportion of the inhabitants is protected by a previous attack; and that the spread of the distemper will often be limited by this cause, aided by others connected with the temperature and states of the atmosphere. This fact will also explain the occasional failure of the very imperfectly-informed and inexperienced experimenters among Egypto-European physicians to communicate the distemper by contact and inoculation. Thus it will be found, in the report to the Academy, that a felon, having been made the subject of inoculation in Egypt, caught the distemper and recovered. Having thus earned his life, he was nevertheless experimented upon subsequently, and not being reinfected, the circumstance was adduced as a proof of non-contagion, although actually being, to the mental vision of all who can see, and duly estimate the most prominent and important truths in medicine, the strongest evidence which could be brought in aid of the opposite and orthodox doctrine. But there is every reason to believe that, as in the cases of smallpox and the hæmagastric pestilence, the infection of plague may be so mild, the febrile

disturbance so slight, the pains in the glands so evanescent, and the swelling so small, as to almost escape notice, or to pass away without recollection of the disorder, and knowledge, or even suspicion, of its nature. Indeed, a very mild grade of the distemper has been described above (§ 21), and is frequently remarked, when this pestilence has been introduced into a crowded city or place. Protection from second attacks may thus become much more numerous than actually apparent from this cause.

105. *B.* The *second proposition* involved in the alternative stated above (§ 103), namely, *is the plague generated, de novo, whenever circumstances favourable to its generation arise?* is answered in the affirmative by the Academy. It would have been instructive, probably most beneficial, if the French commission, during the long period they have taken to consider the matter, had ascertained the several circumstances which combine to generate this pestilence, *de novo*, and distinctly stated them, before they took the proposition for granted, and proceeded to reason upon it as an established fact; the more especially as it has been controverted by the ablest writers on the distemper, and doubted by many. But the commission adopts an easier course, and without any such preliminary and fundamental inquiry, asks themselves the question, *What is the place or places where the plague has arisen spontaneously?* And, after taking a very roundabout way of answering it, they state, without any doubt or reservation, "that the plague has been generated spontaneously not only in Egypt, in Syria, and in Turkey, but also in a great many other countries of Africa, Asia, and Europe." The spontaneity of plague, according to the commission, is thus tolerably latitudinarian, but many will doubt, notwithstanding the greatness of the authority, the wideness of the range, even if they do not dispute the accuracy of the principle adopted. Certainly the question of the origin of this pestilence cannot be readily or easily answered, especially by one who is cognizant of the difficulties which beset it, and of what may be said for and against the doctrine of spontaneity. I confess that I cannot arrive at a positive conclusion as to the matter. There are many circumstances which favour the opinion, and many which militate against it: first of the former.

106. Of all cities or places, Cairo furnishes the most numerous circumstances conducive to the production of this pestilence *de novo*; a crowded population in dirty, close, and ill-ventilated chambers, especially in the Coptic quarter; narrow streets, with open sewers in many places, and abounding with filth; the accumulation of decomposing animal excretions and exuviæ; a rich, deep soil, saturated with animal matter; low, close, dirty, and ill-ventilated habitations; the burial of the dead within the walls of most of the Coptic habitations; contaminated and unwholesome water; adjoining inundations; great humidity of the air during part of the year, and a temperature from 50° to 75° Fahrenheit, are a combination of conditions sufficient to generate a pestilential malady, or, at least, a putro-adynamic form of fever, especially when they exist in marked grades, or, are aided by scarcity of food, by great humidity and stillness of the air, and probably, also, by a negative state of the electro-motive agency in the atmosphere and on the earth's surface. If these do not actually give rise to the pestilence, without any pre-existing germ or seminium, they may be inferred, at least, to be most influential in developing, propagating, and even in perpetuating such a germ; and in giving rise to a susceptibility or predisposition of the population to be infected by it, as far as these favourable circumstances extend, and among all who are not protected by a previous attack or by other causes.

107. Dr. Legasque, the member of a commission which visited Egypt in 1828, 1829, and 1830, to investigate the causes of plague, and to try the action of the chlorides on the pestilential miasm or virus, believes that, although the plague existed before the sixth century, it became more frequent in Egypt in consequence of the practice of embalming the dead having been relinquished after the introduction of sepulture by the early Christians, and that it is endemic in Lower Egypt. He considers that the practice adopted for so many ages in the Coptic quarter, which is situated in the centre of Cairo, of burying the dead within the houses, exerts a powerful influence upon the health of the whole city. There can be no doubt of this, especially aided as it is by numerous other circumstances of an injurious tendency, the chief of which have been already enumerated (§ 106), and he imputes the origin of the plague to animal decomposition; want of cleanliness, scarcity, poverty, the inundations of the Nile, ruinous state of the canals, and insufficient ventilation being only accessory causes. (*Rapp. à l'Acad.*, p. 590.) The same opinion is entertained, also, by several of those who have communicated on the subject with the French Academy. M. Delaporte, in a very able memoir, attributes the development of the pestilence to the same causes; but admits that, when thus produced, it perpetuates and reproduces itself, 1st. By pure contagion, or immediate cutaneous contact; 2d. By infection or internal pneumogastric contagion. It cannot be doubted that, if we admit the spontaneous generation of the pestilence on occasions when all the circumstances concur most efficiently to this effect, that the towns and villages of Lower Egypt furnish them in the most marked degree; but it cannot be also admitted that they stand alone in this respect, for many towns situated near the shores of the Mediterranean present conditions almost as favourable to the production of this effect as those of Egypt.

108. In opposition to the doctrine of spontaneity it may be contended, seeing that the circumstances that combine to generate it, according to this view, must necessarily exist in many places and towns in other countries enjoying the same range of temperature as those of the Levant, and in many cities in Western Europe during the warmer seasons, that this pestilence ought also to be generated in countries eastward of Arabia, as well as in some parts of America. Those who believe that it is propagated by a seminium analogous to smallpox, but not capable of being so long preserved as that of smallpox, are of opinion that the circumstances favourable to, as well as the occasions of, the conveyance of this seminium to the eastward of some parts of Arabia, and to

the westward of Europe and Africa, have not existed; and that when this distemper has appeared, as it has on rare occasions, in some of the northern cities of Europe, on the one hand, and in some of the hot countries of Africa and Syria on the other, it has always spread by the contagion and infection conveyed by persons and the clothes of the sick; but that the low winter ranges of temperature in the former, and the high ranges of the summers of the latter, have always destroyed the poisonous seminium, either by the influence of the extremes of temperature upon it, or by the loss of the power of perpetuation after a certain period.

109. That those very circumstances and occasions which would appear the most favourable to the production of this pestilence *de novo* have often not produced it, even in countries where the pestilence is met with sporadically, and is considered as being endemic by many writers, is a fact which has been demonstrated, and which militates strongly against the doctrine of spontaneity, but which supports that of a specific seminium; for, on these occasions, the absence of this specific contagious or infectious agent accounts for the non-appearance of this pestilence; other maladies, which these occasions generally produce, being the only results. Thus it is stated by Dr. Rossi, that when the Egyptian army were in Syria they were exposed to many of the circumstances supposed to originate the plague, and, especially when obliged to evacuate the country, they were crowded into ill-ventilated transports. Malignant typhus and dysentery, hospital gangrene, &c., then became most prevalent and fatal, but no case of plague occurred. This appeared to be the case especially with the regiment to which Dr. Rossi was attached, and which was not attacked by this pestilence until after its return into Egypt, when it became exposed to the infection during his absence, and, no measures of precaution or prevention having been taken, the distemper had become general throughout the corps. He sent all the infected (about 400) into the hospital, and caused those who appeared in health to bathe in the Nile, to put on clean and purified clothes, and to encamp on a dry and arid soil. As soon as one was attacked he was sent to the hospital, and thus the camp was preserved healthy, and the distemper ceased. Although the occasion of generating the pestilence *de novo* was most favourable in this instance, still it did not appear until the return of the troops to a place where cases of the plague existed; the neglecting of precautions against infection having diffused the distemper, and the adoption of precautions having arrested it. When the pestilence was introduced into Smyrna, as shown by the authority referred to above, it appeared first in the most open and healthy quarter, and advanced the latest, and prevailed the least, in the lowest, most crowded, and unhealthiest quarter; and this in a city supposed by some to reproduce the distemper *de novo*. Besides, it is fully shown by recent researches, and by the recent adoption of sanatory measures by Turkish and Egyptian governments, that the more or less continued presence of cases of this pestilence was not owing so much to the existence of the local causes supposed to generate it *de novo*, as to the want of all precautions and quarantine regulations, and to the neglect of separating the infected from the healthy, whereby the specific infectious seminium was preserved and propagated.

110. Without, therefore, denying the frequent reproduction of the plague in Lower Egypt, by the causes stated above, still the doctrine of an original specific germ or seminium presents many considerations in its favour, and of the same nature as I have adduced when considering the origin of the hæmagastric pestilence. According to the former view, the circumstances above stated (§ 105, *et seq.*) give rise to the sporadic or endemic cases, as they have been called, but they are insufficient of themselves to spread or to diffuse the distemper in an epidemic form, until the epidemic influence or constitution, for which certain modern writers contend —the "*foyer epidemique*"—is actually developed. According to the latter view, the specific contagious agent produces but few, scattered, and isolated cases, in certain localities and towns, as long as the circumstances unfavourable to its propagation exist, as observed in respect of smallpox; while the extremes of temperature, a dry atmosphere, free ventilation, absence of susceptibility in many, and cautious avoidance of crowding, and of intimate or close communication, afford protection; these straggling instances being sufficient, especially when re-enforced by importations from other places furnishing occasional cases of the distemper, to perpetuate the specific agent of contagion. But when the circumstances favourable to the diffusion and operation of this agent appear, as moderate atmospheric warmth, conjoined with humidity and stillness of the air, and probably, also, with a negative state of the electro-motive influence, and with noxious exhalations from the soil, with crowding, and close or frequent communication with the affected, then the distemper becomes more or less prevalent with the grade and combination of these and other favourable circumstances; and these alone, or chiefly, constitute the epidemic influence or "foyer," to which so much is imputed by some recent writers.

111. Now we find that the plague becomes epidemic at one year, or even during two or three successive years, in some countries of the Levant, successively appearing to a most destructive extent in one country, then subsiding, and breaking out in one or several countries; but much more rarely, or not for ages, appearing in more distant countries where precautions against its ingress are taken, and never where these precautions are strictly observed. If we admit, with the anti-infectionists, that this pestilence arises from an epidemic influence alone, such epidemic influence must be of a specific kind, since it produces specific and determinate effects, and occasions neither adynamic fever nor adynamic dysentery, nor either of the two other specific pestilences considered above; and, seeing that this pestilence migrates from one place and country to another, and is actually as eccentric in its migrations and courses as I have described it (§ 86), the epidemic constitution to which it has been thus absolutely imputed must necessarily be equally migratory. Moreover, as it has been most satisfactorily shown, and as sufficient evidence to demonstrate the fact has been adduced, that

this pestilence may be shut out for ages from places where it was almost a yearly visitant, by strict measures of separation and seclusion; and that it may even be shut out and excluded from a house or houses, while all the surrounding houses are infected, how are the persons taking these precautions, I ask, enabled thus to prevent the epidemic influence to which it is imputed from occurring in the town, country, or place from which it is excluded? And if the town or place be invaded by this aerial influence, how are they able to shut it out from any house, or part, in which neither infected persons nor infected clothes are allowed to enter? The persons taking these wise precautions are admitted to be quite incapable of keeping off a single shower of rain, by all the scientific means they can use; how comes it, then, that they can prevent a most destructive epidemic constitution of the atmosphere from visiting a country, although they profess their ignorance of the nature of that constitution, excepting from its effects; and that, when they have carelessly or ignorantly admitted it, they can, as we have seen, ward it off, and prevent its ingress into any house they please? Can anything more completely show the absurdities of the doctrine of epidemic constitution and non-infection, than a knowledge of the facts connected with the development and spread of this pestilence?

112. The truth is, that infection is introduced, however it may originate, by persons or clothes, or by both, in a town or place; and if the conditions favourable to its communication to susceptible persons are present—if the temperature be in neither extreme, or be moderately warm; if the air be humid and still; if the houses are crowded, low, damp, and ill-ventilated, the streets narrow and abounding in filth; and if the communications be frequent and a large number of the population are susceptible, owing to their not having been previously attacked, or to some other cause, constitutional or otherwise, the pestilence soon spreads and becomes epidemic. These circumstances conjoin to constitute the epidemic constitution—the "*foyer epidemique*" of our neighbours, to which they impute the pestilence. But I contend that they are merely the conditions—the circumstances which favour the operation, spread, and reproduction of a poisonous agent—of the pestilential miasm or infectious emanation produced by the infected. As soon as these conditions and occasions disappear—as soon as the temperature sinks to freezing, or rises above 75 degrees of Fahrenheit, and more especially if the air becomes at the same time dry, if high winds occur, and free ventilation in houses or tents is adopted, the infectious poison ceases to be concentrated, is more diffused in the air, and is less capable of reproducing itself, by infecting others, from its being weakened or otherwise changed, and from its ceasing to affect persons who have become, owing to these atmospheric conditions, much less susceptible of its operation, then as soon does the pestilence subside and entirely disappear; unless it be allowed to smoulder on in low, dirty, close, damp, and crowded places, furnishing a few of the circumstances favouring its occurrence, and some persons still susceptible of its action. Thus in Levantine countries, the distemper is said to be endemic or sporadic, occurs in isolated cases, and is ready to become epidemic as soon as the circumstances combine to favour its diffusion. The dose of the infecting poison in the former or favourable circumstances is large, strong, and efficient, and the recipient susceptible of its influence; in the latter, or unfavourable conditions, it is small, weak, and inoperative, and the recipient insusceptible of its impaired power. What has now been stated of the infection of this pestilence does not pertain to it only, or to two or more pestilences merely, but is true of all other maladies of a malignant and epidemic nature, especially of the two other pestilences, of smallpox, and of the other exanthemata.

113. iii. *The arguments which have been used by the anti-infectionists to support their doctrine* hardly deserve any notice, after the ample evidence—after the undeniable facts I have adduced, completely proving that the three pestilences here considered are infectious in a most remarkable manner, under circumstances which are fully described. As the arguments which have been used by the objectors are the same as respects these three distempers individually, I have deferred the consideration of them until all the three have been brought fully before the reader. I even hesitated to consider these arguments at all; because, when a matter is fully and irrefragably established on facts, any argument which can be brought against it—all special pleadings, however ingenious, argue either the fractious spirit of the objector, or some motive actuating him to prevent a belief in the truth. On this account, therefore, the arguments, or, rather, the sophistical puerilities which have been adduced by ignorant, interested, or captious and splenetic persons, hardly deserve a notice, and only when they seem to possess an air of importance—an importance derived only from unwarranted assumptions, confident assertions, and ill-founded pretension; and, in some instances, also from the official or professional position of some of those who have ventured into the field of controversy—and not from any solid array of facts or of inferences logically drawn from facts. But, irrespective of the want of every element of sound argument, a very large proportion of the anti-infectionists betray, as shown above, an utter ignorance of the distempers respecting the nature of which they speak with confidence, and even with disgusting pretension—and not only of these distempers, but even of others, either allied or analogous to them, of which they have incidentally taken notice. This assertion may be conceived by some, who have not had opportunities of judging for themselves in the matter, as severe or ill-founded; but it could be very easily proved if it deserved the space which would be wasted in proving it. Whoever has perused some of the writings to which I allude, and which I have referred to, or others which I have considered undeserving of notice, with that amount of knowledge which enables him to form a tolerably correct estimate of medical writings, will readily admit the accuracy of the assertion; and the attentive reader of what has preceded, and of what has yet to be adduced, will find sufficient reason to arrive at the same conclusion.

114. *A.* It has been argued by the anti-infec-

tionists that the three pestilences now considered are not governed by the laws of contagious, but of epidemic diseases. Now this assertion shows, even of itself, that those who make it know nothing of these laws, and still less, if less he possible, of the matters respecting which they attempt to argue. What is there known of the laws of infectious disease which these pestilences do not actually possess and present? The chief law, admitted even by the objectors, is, that contagious or infectious diseases present precise, specific, and distinctive characters. Has not the whole history of the three pestilences now considered demonstrated the possession of these very characters hy them in a most remarkable manner? Is even smallpox more distinctive or specific than they are all? Is there any one at the present day, who has had the smallest amount of experience, who will not admit the special character of these distempers, unless he be blinded by ignorance or prejudice, or by both, for they are both often combined? But the anti-infectionists say that other maladies, admitted by them to be infectious, affect a person only once in his life, but that this is not the case with the pestilences now described. Here, again, their ignorance, or their dishonesty, is most barefaced and egregious; for they should know, if they really do not know, that a second infection is even more rare, as shown by facts out of number, as regards two out of these three distempers, than even the exanthematous fevers, whose infectious nature they admit; and that opportunities have not yet been afforded, at least in Europe, to test a similar property in the third of these distempers. In truth, there should he an end of all argument with such persons, as being unworthy of the distinction conferred by fair argument; for they will neither see, nor acknowledge, nor appreciate fairly, any fact which may be construed unfavourably to their views; but will endeavour to controvert it hy misstatements and drivelling doubts, when they find it to he otherwise unassailable.

115. Oh! exclaim these pseudo-philosophers, who wish to make infection appear a prejudice, a vulgar error, and who, in the fulness of their vanity, desire to seem altogether above every thing that can be accounted a vulgar or general belief—these pestilences are merely epidemics, observing the laws of epidemics, and are hence not infectious. Yet what do they know more of the laws of epidemics than their opponents, who admit that these pestilences are very frequently epidemic, and are mostly known as such in Europe; hut who also contend that they are likewise met with in solitary or scattered cases, in the countries which present the climate and circumstances favourable to their preservation during all seasons; and that their occurring in an epidemic form—their more general prevalence—is only the result of the existence of the several conditions and circumstances which admit of the concentration or accumulation of the infectious miasm which favour the development and operation of it, and which thereby promote the diffusion of infection, especially among susceptible persons, and those who have not passed through the distemper; and still more remarkably when these are collected in numbers, or are crowded in towns and cities, or are otherwise placed in circumstances predisposing them to the invasion of the pestilential emanations from those already infected. According to the non-infectionists, the pestilential cholera was considered an epidemic depending upon aerial conditions, and was hence termed epidemic cholera. The calamitous consequences of opposing a suppositious aerial or tellurial influence, or a combination of both—for suppositions were varied, and even numerous as to the matter—to a manifest property of the distemper to spread from the sick to the predisposed among the healthy, like all other infectious maladies, and the confident assertions and assumptions employed to conceal ignorance, have been already beyond the power of human calculation to estimate as respects this single pestilence merely; they are still frightful and extensive, and they may even become much more so, and be indefinitely perpetuated.

116 Still, the non-infectionists exclaim, these pestilences, choleric, hæmagastric, and glandular or septic, are merely epidemics, prevail only as far as the epidemic influence extends, and are the results of the "epidemic foyers." Has, however, the choleric pestilence, which has continued to prevail, more or less, for nearly thirty years in India, been an epidemic during all that time? Or has it not rather been, as I have shown, an infectious distemper preserved in that country, hy the absence of all attempts to prevent infection, or to limit the spread of it, and by the circumstances of the climate, but prevailing more or less, or becoming more epidemic at one place than another, as occasions arose favouring its diffusion, and predisposing those exposed to it? The truth is that, when the various occasions and circumstances concur to develop lurking cases of either of these pestilences into an epidemic form, it prevails to an extent influenced and limited by these occasions and by the numbers of the predisposed within the boundaries to which infection has extended, and then subsides; sometimes having exhausted itself for want of susceptible subjects, when the circumstances favourable to its diffusion have continued without mitigation; at other times subsiding without occasioning great fatality, when these circumstances have either been but slightly favourable to its propagation, or when others have tended to arrest or limit its extension. In most countries where these pestilences prevail without attempts having been made to limit or destroy the infectious agents, they are perpetuated, by communication with the sick, and by the clothes of the infected, in solitary or scattered cases—scattered more or less profusely in some localities, and in certain seasons, than in others—until the favourable occasions of temperature, humidity, and stillness of the air, conjoined with susceptibility and crowding of the population, have developed them into an epidemic prevalence. In other countries or climates, where the infectious agent is destroyed, or is allowed to extinguish itself by removing it from the reach of susceptible subjects, or where it dies away from the occasions requisite to its propagation being absent, the pestilence is no longer heard of for a time, until an infected person or infected clothes again introduce the distemper, which

becomes more or less prevalent according as circumstances favour its spread; and thus it may prevail, then subside, extend to another place, disappear, return, and become epidemic in succession in various situations, as usually observed in respect of the plague in the Levant. The opposers of infection — the supporters of the doctrine which attributes all the effects observed in the course of epidemic maladies to epidemic constitutions or influences merely—to "*foyers epidemiques*"—cannot produce a single epidemic of any pestilence, the several phenomena of which can be fully accounted for by the agency or influence which they invoke, but of which they can neither demonstrate the existence, nor assign any indications of its presence, beyond the mere circumstance of the spread of the distemper from the sick to the healthy, with more or less unusual or remarkable frequency. Now the infectionists contend that this propagation of the disease is the result of a morbid effluvium proceeding from the sick and infecting the susceptible among the healthy, all other occasions and circumstances existing at the time being only aids of this efficient cause; and they challenge their opponents to an examination of both doctrines with an honest regard to facts, more especially to those facts which are open to the scrutiny of all candid minds, and from which alone, and not from argument, the truth is to be elicited.

117. The non-infectionists contend, as a proof that pestilences are not infectious, that "they break out at a certain season, last for a certain time, and then subside and remain dormant until a favourable season returns;" while, on the other hand, they assert that "contagious diseases can be propagated at any time and among any number of persons;" and that "a disease depending upon a specific contagion must prevail alike in all seasons, in a pure as well as in an impure atmosphere, among the rich as readily as among the poor; and that the only influence of these adventitious circumstances would be to render the disease more or less severe." Now I have, on more than one occasion, accused the non-infectionists of ignorance of that science with which, unfortunately for the causes of humanity, they have meddled; and some may have supposed the accusation harsh, or even ill-founded; but, can a more convincing proof of the fact be adduced than the very arguments they have employed to support their doctrine — the very weapons which they have wielded in a conflict involving the interests of the community? Is there one medical man — one who has the smallest right to a title, which should claim respect from all well-constituted minds—who could make the assertion contained in the latter part of the above quotation, with the least shadow of truth as regards any one disease which is either contagious or infectious? On the contrary, it is known to all who have either observed for themselves, or read the observations of others, that all contagious or infectious maladies, propagated in the natural way, spread readily at one time, and scarcely at all at another; that hooping-cough, scarlet fever, measles, smallpox, and even rabies, are more prevalent at certain seasons than in others; that either of these maladies may for some time be rarely or never seen, then break out, and be more or less prevalent. There is no disease more demonstratively both contagious and infectious than smallpox, or in many respects more analogous to plague. Now let us see what was the usual mode of its appearance before it was controlled by inoculation and vaccination. Before smallpox was thus interfered with, it is well known that it used to lie dormant, then appear, rage for a time, and then subside, like those pestilences now considered, and which have been imputed by the non-infectionists to epidemic influences. There can be no greater authorities adduced respecting smallpox, before the introduction of inoculation, than Sydenham, Boerhaave, and Van Swieten; and they describe it as appearing and running its course like epidemic diseases. Sydenham remarks that "one and the same disease kills an infinite number at some certain seasons, and at another time seizes only here and there one, and goes no farther; and this is very apparent in the smallpox, and especially in the plague." Boerhaave observes that "this disease is generally epidemical, beginning in the spring, increasing in summer, abating in autumn, ceasing almost entirely in the following winter, to return again in the spring;" and Van Swieten states, "I have seen many variolous epidemics, and they agreed in most things with the observations of Sydenham."

118. *B* So much for the medical knowledge of the non-infectionists as evinced by their arguments, and on occasions when exact knowledge, and not ignorance, should have been put prominently forward. I shall next furnish an example of the "*suppressio veri*"—of the honesty of their arguments. "People are attacked," states a pillar of the non-infectious faith, "not in proportion as the inhabitants of the affected mix with those of the unaffected places, but in proportion as the inhabitants of unaffected expose themselves to the *air* of affected places. The visits of the sick to unaffected places is [are] followed by no increase of disease; the visits of the inhabitants of an unaffected to an affected place is [are] attended with a certain increase of sickness. On their removal from a noxious to a pure air, the sick often rapidly recover; but they do not communicate the disease to the inhabitants of a pure atmosphere." Now I can affirm that, amid the numerous worthless statements which I have been doomed to peruse—of the multitude of medical facts or medical lies which have come before me—none has been more impertinently false than the above. The short passage now quoted conveys, with its unmitigated falsehoods and bad grammar, two distinct propositions, in several ill-expressed forms: 1st. *That when the people of healthy districts visit the affected districts, they take the disease not from the sick, but from the air;* 2dly. *That when the sick move from an affected to a healthy district, they speedily recover, and do not give the disease to others.* These propositions are the *basis* upon which the non-infection faith reposes, and are extended by the apostles of this faith to the three pestilences which I have been considering. I shall, therefore, bestow somewhat more notice on them than they deserve, and show—what, indeed, most of what I have

adduced in any way connected with the subject must have already shown—that they are as baseless as the visions which haunt the imaginations of the trembling and sickly drunkard when deprived of his accustomed stimulus. Having demonstrated the non-existence of the grounds upon which a belief in non-infection is based, this most dangerous doctrine—a doctrine pregnant with the worst consequences to the community—is consequently swept away, and entirely removed from rational minds, a belief in it being merely a matter of history, and an illustration of the progressive advancement of the human mind.

119. *a.* If, according to the *first proposition* of the non-infectionists, *those who come out of a healthy into an infected district take the distemper, not from the sick, but from the atmosphere of the district*, then it follows that those who avoid the sick, or the clothes of the sick, shall he as liable to the distemper as those who approach or touch them. Now is this the case with the plague, or with any of the other pestilences I have discussed? The contrary is so notorious as to require no farther demonstration than it has received in the preceding articles; and if farther demonstration be required, let a mere reference to the numerous instances of the protection afforded by seclusion in the midst of an infected population, on occasions of the prevalence of either of these pestilences, be sufficient; and a sufficient number of these instances has been adduced, in the course of the preceding pages, to satisfy the candid mind. Let the reader peruse the facts I have adduced, proving, as respects each of these distempers, that the healthy will remain protected amid a dense infected population—while surrounded by the sick and the dead—as long as seclusion and avoidance of all communication with infected persons or infected clothes are observed. These facts are undeniable, and are not to be assailed by the loose statements of ignorant men, expressed in the bad grammar, and worse English, indicative of minds insufficiently informed for those investigations which are necessary to elicit the truth, and to trace its relations to matters held in dispute.

120. *b.* The *second proposition*, that *when the sick move from an affected to a healthy district, they speedily recover, and do not give the disease to others*, has been sufficiently characterized by me above (§ 118), and is entirely false, as may have already appeared from what I have adduced in various places. That the infected should be less severely attacked when removed from crowded, close, low, or ill-ventilated places, to dry, elevated, and well-ventilated situations, may he inferred. It is one of the circumstances most strongly insisted upon hy the infectionists, with reference to the three grand pestilences of modern times; and it has been more efficiently acted upon hy them than by their opponents, as demonstrated at Gibraltar and other places. But, unfortunately, numerous exceptions to the generally good effects of removal occur; for, once the infection has taken place—once exposure to infection of a manifest or concentrated kind has occurred—a severe and fatal grade of distemper will often be developed notwithstanding that the removal to a pure atmosphere has immediately followed the infection. Instances proving this fact are numerous, and too familiar to every experienced observer, as respects the three pestilences under consideration, to require a more particular notice than that which has been already taken of the subject. It has, moreover, been shown that a more or less elevated temperature and stillness of the air are necessary elements in the development of the epidemic prevalence, of at least two of the pestilences in question, if not of all three; and, consequently, it follows that a reduction of that temperature and free ventilation will be favourable to the infected, and will he more certainly secured by removal. Hence removals, with advantages as to temperature and ventilation, will prove more especially beneficial. But it may be inferred that a removal, even to a purer air, when the reduction of the temperature of that air is slight, will not be so manifestly advantageous as when it is much more considerahle. Thus it was shown, on a very recent occasion, that when the crew of the "Eclair" steam-ship, the infected and the healthy, were removed from this vessel, which, according to the non-infectionists, was the cause of the disease to all those who were not exposed to malaria in Africa, and were landed at Bona Vista, the distemper was not thereby mitigated in any degree, but continued to spread among the crew, and subsequently to the inhahitants of the island.

121. The assertion made by the writer quoted above (§ 118), that the visits of the sick to unaffected places are not followed by the propagation of disease, is the most outrageous and unblushing falsehood which has ever desecrated medical doctrine or disgraced medical writings—a falsehood, moreover, which, if believed in and acted upon, would on numerous occasions endanger the lives of the majority of the community in every civilized, or even partially civilized, country. Can such an assertion deserve the least notice, after the numerous proofs to the contrary adduced in the preceding pages?—after the instances I have referred to—and thousands more might have been mentioned if my limits could have admitted them. I shall, however, notice two which I have just seen in the course of my reading. Mr. HOWARD, in his celebrated work, states that "when the plague raged in London in 1665, the infection was conveyed by means of a parcel of clothes to the remote village of Eyam, near Tidewell, in the Peak of Derbyshire. In this place it broke out in September, 1665, and continued its ravages upward of a year, when 260 of the inhabitants had died of it." "In the surrounding fields are many remains denoting the places where tents were pitched; and tombs are still existing of large families entirely swept away by this devouring pestilence." (P. 24.) The plague is very rarely introduced into Arabia, the passage across the desert, and the state of the climate in many parts of the country, being unfavourable to the development and spread of its infection; and it is generally admitted that the pestilence has never appeared there unless when imported, as was the case in 1815, by the army of MOHAMMED ALI, which crossed the desert into Arabia on an expedition against the Wahabees. Dr. BABINGTON, the eminent physician to GUY'S Hospital, who came over land from India at this time, remarks, in a communication to Dr. GOOCH,

that the plague had then visited Yambo and Jedda, and crept down the coast as far as Gamfada, and that each of these towns had lost nearly half the population. He, moreover, adds, that when he was at Milo, in the end of 1815, a vessel came into the port having one person on board ill with the plague. This vessel was ordered by the Greek authorities to quit the harbour. She put into Mitylene, where those in command, being less cautious, allowed the sailors to land, several of whom had by this time become infected. The distemper immediately afterward broke out among the islanders, and many fell victims to it. It is unnecessary to adduce farther proofs not only of the utter worthlessness, but of the insane recklessness of the assertion, which I have now sufficiently noticed. Indeed, the full evidence I have brought forward of the infectious nature of each of the pestilences considered under this head, completely overthrows the position so rashly assumed by the non-infectionists.

122. But, as shown above, and admitted by the contagionists or infectionists themselves, the plague is not always propagated; when those sick of it, or the clothes of the infected, are removed to a place or places which is altogether healthy, or free from the pestilence. This circumstance has been fully explained; but because, like all other infectious maladies, this requires certain conditions for its epidemic prevalence, and because it is not universally diffused; because it is not widely and generally propagated on all occasions and circumstances whatever, the non-infectionists raise an argument against its infectious nature. The occasions and circumstances favouring the spread of this distemper are hereafter shown (§ 124, 127, *et seq.*), and those preventing the propagation of it also stated (§ 126). That there should exist such occasions, is only in accordance with the laws of nature, and with the phenomena characterizing all acute infectious maladies. The same takes place in respect of the smallpox and the rest of the exanthematic, and it is notoriously the case as regards the other pestilences. Before the introduction of inoculation, smallpox, as respects its epidemic prevalence, presented the same laws as the plague and other infectious maladies which frequently appeared in an epidemic form. Van Swieten, who saw the smallpox when it was propagated only in the natural way, remarks as follows: "I have sometimes observed large towns to be free from the smallpox, while it raged epidemically in the neighbouring villages; and, on the contrary, some large towns universally visited by the complaint, while the villages in the neighbourhood remained in health, though the inhabitants of both mixed daily with each other. I also perfectly remember that I once removed two patients of mine from a place where the smallpox raged to a large town, without propagating the contagion there; and many excellent physicians, with whom I have cultivated a friendly commerce with respect to medical knowledge, testify that they have observed the same thing." A similar fact is mentioned by Sir John Pringle. He states that "the smallpox, being carried into a camp by some newraised recruits, quickly disappeared without becoming general, although it is notorious that other camp diseases are but too apt quickly to spread themselves." Dr. Odier, in a letter from Geneva to Dr. Haygarth, says: "We have frequently inoculated, at Geneva, a great number of children in the years during which the smallpox was not epidemic; these children have gone out every day, even after the eruption had broken out; they have been in the streets, and in the public walks; they have communicated freely with other children susceptible of the infection, and not only the smallpox did not spread, but there did not occur, to my knowledge, any distinct instance of the communication of the disease from one individual to another in the streets or promenades."

123. I have now taken as much notice of the chief arguments of the non-infectionists as they deserve. Who will not be convinced by what has been adduced above, are not likely to be convinced of the infectious nature of the pestilences here considered, by anything whatever that may be advanced. I can only add, for the consideration of the inexperienced and incautious, that, after what I have stated on the subject, with a perfect conviction of its truth, and after the fullest and most extended research it was in my power to bestow upon the subject, if they neglect those measures which are calculated to prevent infection, in the several circumstances in which it may be likely to appear and extend; if they act recklessly, as the numerous occurrences of these pestilences have presented many examples, and despise the doctrine of infection and all protective measures, they will open the flood-gates of an overwhelming calamity, in which they themselves, among many others, may be swept away; or, if they should survive, they will have an account to settle with their own consciences of no small amount. At the present day, persons are endeavouring to overturn belief in a doctrine most essential to the safety of the community, and are attempting to oppose their opinions to the views and doctrines inculcated by the master minds in our science—inculcated for the promotion of the best interests of humanity, and inculcated, moreover, with a perfect conviction of their truth.

124. iii. *There are some circumstances which predispose to, and others which appear to counteract, the infection of plague*, besides those just referred to. My limits will only admit of a brief notice of them.—*a*. It has already been remarked that extremes of *temperature* arrest the spread of this pestilence. It has long since been stated by Volney and others that the winter temperature of Constantinople puts out, but that spring and summer heats rekindle, the distemper. But it is very questionable whether or not the infectious miasm is destroyed by the cold, or is merely rendered inoperative or dormant; and, although the spring and summer heats resuscitate the pestilence, it is very doubtful whether this effect is produced by the generation of the distemper *de novo*, by the influence of a higher range of temperature upon the decomposing animal exuviæ and other materials; or whether the dormant infection is thereby rendered operative and called into activity, or even whether the infection is introduced on several occasions, and at several points, by infected vessels and travellers, and especially by the numerous pilgrims returning to or passing through this city, and that the

infection spreads as soon as the occasions favourable to its extension supervene. That this last is the true reason of the prevalence of the distemper during summer in this city is shown by the almost total disappearance of it since quarantine regulations were adopted in 1839. In Cairo and other towns in Lower Egypt, as well as in some parts of Syria, where the winter temperature is much higher, the distemper becomes epidemic, or, at least, more or less prevalent, usually at a much earlier period of the year, generally in March, April, and May, and subsides when the temperature rises above 75 or 80°.

125. *b.* It is, however, not so much the temperature as the *humidity* of the air which favours the extension of this pestilence, and the former may be said to be operative only when it is conjoined with great humidity. This is evinced at Constantinople, where the air is very humid in spring and summer, owing to the influence of the adjoining seas, the extensive forests, and high ranges of mountains. In Lower Egypt and Syria, especially in places near the coast, the winter and spring are humid and rainy, and the atmosphere close and still; and although the range of temperature is not high, still the close and moist air favours the accumulation of the emanations proceeding from sporadic cases of the pestilence, or from clothes retaining these emanations, and renders those exposed to them more susceptible of their influence. When, however, the atmosphere becomes dry, whatever may be the range of temperature, the pestilential miasm loses much of its power, and the population, or those exposed to it, much of their susceptibility. It is, therefore, chiefly owing to the combination of heat with humidity that the former is influential in the diffusion of this pestilence.

126. *c.* The *winds* have no mean influence in the development and spread of plague, especially in the East. At Constantinople, the north wind, called the Tramontana, which is dry and cool, prevents or arrests the progress of the distemper; while the Sirocco, or south wind, which is both warm and moist, favours the development and spread of the malady. High winds, especially when they are dry, remarkably diminish the infectious disposition, and restrain and arrest the propagation of the disease, chiefly by dissipating and diluting the miasms proceeding from the infected, and giving rise to freer ventilation in crowded streets and houses. The salutary effects generally derived from placing infected troops or communities in tents, upon a dry, arid, or healthy soil, proceed chiefly from the readiness with which the winds pass under the tents and dissipate morbid emanations, or dilute them so as to render them inoperative. Dry winds, also, render the human constitution less susceptible of contagion. Thus it has repeatedly been observed that the Harmattan, a remarkably dry north-east wind, occasionally blowing for several days on the west coast of Africa, suspends the infection of smallpox, and that even inoculation of that disease is generally inoperative while it blows.

127. *d.* The *electrical conditions* of the atmosphere have been supposed to be more or less influential in producing epidemics of plague and of the other two pestilences; but the particular electrical conditions have not been shown, the negative state being most frequently accused. Very probably electricity, as it circulates through the animal economy and other objects on the earth's surface, and passes off into the atmosphere, by its varying states and its influence upon the nervous system, impairs in some cases, and increases in others, the nervous power and vital resistance of the frame, thereby rendering them more or less disposed to the invasion of infectious agents, and, as observed in respect of its influence on dead animal matter, imparting more or less of a septic tendency to the fluids and soft solids. Still, the actual amount of influence of this agent on the living body is unascertained, and probably much exaggerated by many, especially by those who impute epidemics to atmospheric conditions, without admitting the efficient agency of specific infection.

128. *e. Local* or *endemic conditions* have been much insisted upon by some writers, and by several of those who have communicated with the French Academy on the subject of plague; these conditions, especially the accumulation of animal exuviæ, the decomposition of dead animals, incomplete modes of human sepulture, and burying the dead in vaults and crowded churchyards situated within or nearly contiguous to towns and cities; imperfect drainage, and the passage of decomposing animal fluids and excretions into cess-pools, into a low, wet, and rich soil, or into canals, open drains, &c.; collections of animal and vegetable matters left to decompose in the air surrounding low, damp, and ill-ventilated dwellings, or in narrow and crowded streets; living in cellars or in close apartments on the ground, and having merely the soil impregnated with animal secretions and the fluids from animal decomposition, for a floor; adjoining marshes, estuaries, low grounds subject to inundations, ruinous and obstructed canals, stagnant waters, &c.; a deep, rich, and humid soil, accumulated for ages from the decay of animal and vegetable matter, and from the mud and slime produced by repeated inundations and evaporation by a warm sun; scarcity and unwholesome food, and the use of water contaminated by animal matter, by the decomposition of organized bodies, or by the infusoria, severally exert no mean influence in the development and spread of plague and other pestilences. It is seldom, however, that one or two merely of these conditions are found existing in a locality or town in the East without being associated with others, or even with nearly all those now enumerated; and if they be singly injurious, as they must be admitted to be, how much more so must they prove when associated, and the emanations from them are elicited by heat, and accumulated in a humid and stagnant atmosphere. It is to the combination of a number of these, aided by moderate warmth and humidity, that many recent writers impute, as I have shown above (§ 106, *et seq.*), the generation of this pestilence *de novo*, and its endemic and sporadic existence; while others have maintained, in opposition to this view, that, so far from these circumstances having generated the plague, or given rise to sporadic cases, or to an endemic form of the pestilence, they have

actually been unfavourable to the prevalence of it when it has been epidemic, and that quarters of cities where they have been most remarkable have suffered the least from it on these epidemic occasions. It has been stated, even by the supporters of the origination of this distemper in these causes, that the Jews' quarters, and others the most filthy, and combining most of the conditions just specified, have suffered the least in various epidemics which ravaged Cairo, Smyrna, and other towns in the East; and an argument against the accuracy of their own views, as to the origin of the pestilence, has thus been furnished by themselves.

129. There can be no doubt of the injurious influence of these causes, acting either singly or in combination, upon human health; and of the fact of putro-adynamic fevers, typhus, adynamic dysentery, and other maladies having originated in a combination of two or more of these circumstances, more especially when aided by warmth, humidity, crowding, and imperfect ventilation; but that they generate *de novo* this pestilence, may be disputed, as shown above (§ 41), or even that they constitute the sole source or centre of epidemic influence during fatal prevalences of this distemper. Indeed, the precise part which these circumstances perform, the amount of influence which they severally or conjointly exert in the generation or in the diffusion of this pestilence, has not been clearly ascertained. Their noxious influence has been more a matter of inference than of demonstration; and numerous facts seem to show that other circumstances, often associated with these, although not necessarily connected with them, are more concerned than they in the spread of the distemper; that crowding, and the close and frequent communications with infected persons, and pestilential emanations from the clothes and bedding of the affected, and from their persons, and the concentration of these in a stagnant and humid atmosphere, are the principal and efficient agents of general infection; and that the several local or endemic states above enumerated (§ 128) are operative chiefly in as far as they concentrate or accumulate these emanations, and prevent their dilution or dissipation in the surrounding air, [and displace pure air.—*T.*]

130. *f. Modes of sepulture* have not received due attention, especially with reference to the generation and diffusion of pestilential diseases. In many places in Africa, especially among the pagan and negro tribes, and even among the Copts, the dead are generally buried in the houses or huts of the living; and as many of the dwellings have no other floors than the earth itself, it must follow that, in the more populous and older towns, a most fruitful source of disease exists in the very dwellings of every family. This practice may be concerned in the origination or propagation of the hæmagastric and septic pestilences, especially the former; but how far it is actually so concerned cannot easily be determined. That it is injurious to health, cannot be disputed. I believe that it is more influential in the generation and spread of pestilence than the other local causes above specified (§ 128), especially in humid and stagnant conditions of the atmosphere, and when aided by several of these causes. It was observed, during the French Revolution, that the trenchings, &c., made in many burying-grounds in order to obtain nitre, occasioned malignant fevers. And M. Borrini, secretary to the sanatory establishment at Alexandria, states that a cemetery near the city, in which more than 500 bodies were interred, during the plague of 1834 and 1835, was opened in 1837 for the foundation of an edifice, and the plague appeared in the following spring. But it is difficult to determine, in this instance, how far this circumstance was concerned in originating or in propagating the distemper of the following spring. Although facts have been adduced having some reference to this matter, they have been superficially observed and loosely described. That these occurrences are productive of malignant fevers and adynamic dysentery, cannot be doubted. I have met with instances of adynamic and putro-adynamic or malignant fever, which have proved fatal as early as the sixth day, caused by the foul air emitted from burying-grounds and vaults in this city, and that foul air from similar sources in warm climates, and even in colder countries in warm seasons, and in a more concentrated form, should occasion plague, is not improbable, although not so fully demonstrated. The evidence as to the origin, *de novo*, of the specific form of pestilence now under consideration from this source, is too deficient to admit of my connecting them as cause and effect. The subject requires farther investigation before either the affirmative or the negative can be admitted. There is one circumstance which may be mentioned, that, although in the great plague of London about 100,000 dead bodies were put in the ground very near densely-inhabited places in London, and although they were thrown into pits, each containing many thousands, and were covered only by a shallow layer of earth, still this pestilence was not continued during the years immediately following; but a malignant typhoid, or putro-adynamic fever, caused by the effluvium proceeding from the burying-places, and an adynamic or putrid dysentery, occasioned by the water contaminated by these sources, were remarkably prevalent in London during several years immediately consequent upon the plague. Similar occurrences are recorded to have followed very fatal epidemics of plague in other cities, but their causes have rarely been recognised or even inquired into.

131. It is, indeed, a matter of surprise that a chief source of the most malignant diseases—a source rendered manifest to the senses in the most disagreeable manner, and so easily connected with its effects—should be allowed so long to exist in civilized countries, and more especially in this, without the least interference; but this is only one of numerous instances of the disregard of health and life by governments in which particular classes obtain the power of legislating for their own interests, and in favour of property, with a total disregard of the public health, and of the protection of human life. The loaf of bread exposed to the tempted gaze of the starving is protected from his grasp, and the miserable wretch who cannot withstand the temptation placed in his way is made the subject of the severest punishment, contrary to the Mosaic law, so conveniently adopted in other matters; while the interests involved in the traffic of

burial vaults and grounds in the midst of crowded localities, prosper by the increasing amount of mortality they produce; and, while the proprietors are fed and made rich by the very deaths they occasion, their interests are respected by the law and by the legislature, and the murderous traffic is allowed to proceed. But this is not the only way in which the public health and human life are made the wholesale objects of commercial speculation and private gain, protected by the glorious stringency of the laws in behalf of property. The vender of poisons, whether with the intention of destroying, or with the avowed object of restoring health, is allowed to pursue his murderous vocation not only without hinderance, but is actually more efficiently protected in the exercise of it than the educated and scientific physician, who has devoted his whole energies to the honest and salutary performance of what he professes. Both kinds of depredators on human life have obtained, by the favours of the laws and of the expositors of these laws, by the forbearance of the legislature, by the ignorance of the aristocracy, by the devotions paid to wealth to the neglect of worth, and by the state of society generally in this country, vested rights in their vocations; and at the present day they are encouraged by church and state, and even applauded by numbers in the community, during the unblushing exercise of their hideous iniquities—

> "Murders most foul, as in the best they are;
> But these most foul, strange, and unnatural."

132. *g*. There are few causes more accessory to the prevalence of plague than *scarcity, and unwholesome articles of food*. Insufficient and unhealthy nutriment increases the septic tendency so remarkable in this pestilence, and favours glandular enlargements. The use of tainted animal food, of half-putrid meats and fish, of unripe or injured grain, and of numerous other unwholesome articles, often partaken of during periods of scarcity or want, although not originating the pestilence, certainly increases the susceptibility to, and the spread of, infection. Hence the remarkable prevalence of the distemper on several occasions when the infection has been introduced into a place subject to scarcity or famine. Fatigue, all exhausting causes, especially sexual indulgence, mental depression, dread of infection, and want of sleep, dispose the system to an attack.

133. *h*. There is much difficulty in determining the *influence of sex*, *age*, and *occupation* in favouring the infection of this pestilence. Much depends upon the exposure to which each is liable during an epidemic; and this will necessarily vary in different countries and epidemics. There is no doubt of medical men and hospital attendants, and next to them the ministers of religion, having been more frequently attacked than any other class—a circumstance altogether arising from their greater exposure to infection. All those who were employed in burying the dead, in removing and attending upon the sick, or whose avocations brought them in contact with the affected, or with their clothes, or even near to them, have rarely escaped in any epidemic of which particular accounts have been furnished, unless they were protected by previous attacks of the pestilence. It is said that the water-carriers, and the oil-pressers and preparers in Cairo and other Mohammedan cities, generally have escaped, and that the immunity of these classes was very evident in the epidemic of 1835. Tanners, curriers, and skin dressers have been found more exempt from plague than other artisans, as shown in numerous epidemics in both Europe and the East.

134. *i*. The plague, like smallpox, spreads more *rapidly, generally, and fatally among the negro and other dark-skinned races* than among the Caucasian race. In this respect it is opposed to the hæmagastric pestilence, which attacks more especially the latter. It was observed in the Egyptian epidemic of 1835, that the negro inhabitants were attacked and died in much larger proportion than others. The natives of countries, also, approaching the tropics, and even of those of the south of Europe, have been considered more liable to the plague than those of the north; and persons having weak and susceptible nervous systems, and feeble or disordered digestive organs, also have been said to be more predisposed than others; while those who are labouring under diseases attended by purulent or other discharges generally escape. Larrey remarked that the soldiers who had been wounded, or had sores or ulcers, were not attacked so long as their wounds or sores yielded a puriform discharge, but that they were not unfrequently seized as soon as the discharge ceased. During periods of the plague in Europe, numbers of persons have had recourse to artificial purulent discharges as a prophylactic measure, and frequently with success.

135. iv. *The hypothesis of insect life as a cause of disease* has been applied to plague and other pestilences. Dr. Holland has discussed this hypothesis, in connection with the choleric pestilence, with great ability and eloquence (*Medical Notes and Reflections*, &c., 8vo, Lond., 1839, p. 560), and adduced every consideration that can be entertained in its favour. Much of what may be said regarding the origin of that pestilence in this cause is equally applicable to the plague. Admitting that swarms of insects sufficient to cloud or to obscure the atmosphere may exist in it, and yet be so minute individually as to elude the unassisted vision; that the numerous infusoria, &c., detected in fluids by powerful instruments is a strong argument, from analogy, in favour of this opinion; that these swarms of insects may be generated from the decomposition of dead animal matter, and that the circumstances which favour such decomposition may also favour other modes of existence too minute to be detected by our grosser senses; and admitting, moreover, that these insect swarms may be inhaled into the lungs, or be absorbed, they or their ova, from these and other surfaces, and occasion the most noxious and fatal effects, and that they may so travel as to explain certain courses taken by this and the choleric pestilence, still there are many facts and considerations which weigh strongly against this hypothesis. Indeed, all that has been adduced against the opinion of the atmospheric origin of these pestilences apply equally to this doctrine. If swarms of insects passing through, or floating in the air, too minute to be perceived, and hence capable of passing into the circulating vessels, and there produ-

cing fatal distempers, were actually capable of occasioning what has been imputed to them in respect of either of the pestilences in question, we should expect a more or less simultaneous affection of the population of the district through which they passed; and seclusion or separation could not be viewed as being more likely to protect from this cause than from the atmospheric constitution contended for by others. It would be difficult, also, to connect what can be believed possible of such insect swarms with the several epidemic manifestations, and sporadic or endemic appearances of this and the other pestilences.

136. But these insect swarms have not been proved to exist in connection with individual cases, or with the epidemic prevalence of plague or other pestilence. Those manifest and palpable swarms which have been occasionally observed in most countries, to such an extent as to darken the air, and to colour the objects on which they rested, and which furnish the chief argument for the existence of those supposed to be productive of plague or other pestilence, have not been found destructive of human life, although productive of more or less disorder. The transmission, also, of these distempers from one place to another, the transport of plague from the east to places in the west or north of Europe, and the various circumstances connected with the transport or appearance of pestilence in various distant, or even adjoining places, are not consistent with insect swarms existing in the atmosphere.

137. It is more probable that the material emanating from the infected, whether denominated the pestilential miasm, emanation, or effluvium, and infecting the susceptible among the healthy, either by direct or mediate contact, or by the respiration of the air more immediately surrounding the sick, actually consists of innumerable, impalpable, and invisible but living and organized existences, generated during the distemper, and thrown off as the distemper proceeds, in so minute but specific forms as not to be visible to the eye, although often admitting of recognition by the sense of smell. It is no very extravagant notion to conceive, what has the support of numerous circumstances and analogies, that during the more or less rapid effluxion of the vitality endowing the frame in this and other pestilences, the effluent vitality may associate itself with certain materials or molecules furnished by the diseased body, and thus may assume the state of organized existences, of specific form, but invisible and impalpable size, capable of infecting the healthy, and, by means of the malady they produce, giving rise to similar specific existences, thereby propagating, spreading, and perpetuating their kind. These innumerable and invisible existences, or organized swarms, whether thus equivocally generated by changes in the states of vitality and organization in the highest of animals, or capable of perpetuating themselves by ova, may be supposed to assume certain determinate forms in each specific pestilence, the specific characters of which may depend upon the determinate forms thus assumed, and upon the manner these forms invade and affect the organs of our frames. It might be futile to add more in favour of infection by means of organized existences or parasites generated by the diseased, although much more might be added in support of the doctrine; but we well know that in proportion as the vital energies of the frame languish or are impaired, so are the parasitical animals peculiar to each of the higher animals more numerous, swarming, and fully developed; and it is not unreasonable to infer, that as vitality, apparently, changes its form, its conditions, and material alliances in these cases, probably without even the intervention of ova, and merely from the effluence of the vitality of the parent, and the combination of that effluent portion of vitality with molecules of matter which it fashions into certain specific forms, and which, moreover, although thus equivocally generated, it may even endow with the power and with the organs of reproduction. Rejecting, therefore, on the one hand, the doctrine of insect swarms floating in the air and producing pestilence, as being deficient in the evidences of their existence, and of their operation on the economy consistently with the phenomena presented by pestilence, and believing, on the other hand, that the opinion as to the material or emanation infecting the healthy is a living and organized material, consisting of innumerable and invisible forms or existences given off from the diseased body, has sufficient analogies and other evidences in its favour, I would recommend the future investigation of this subject by means of those aids which are now so much employed in physiological and pathological researches.

138. v. *There are certain conclusions respecting the causes and propagation of plague* at which I am disposed to arrive, after the best consideration I could devote to these matters. I believe that they are consistent with the best evidence I can obtain, and with the actual state of our knowledge. If any of them be found inaccurate, the disposition to correct them shall not be wanting.

139. *a.* The amount of evidence (as I do most firmly believe the proofs of the last century equally valid with those of the present) favours a belief in the communication of the plague by contact of infected persons or clothes. Although the contact of these will very frequently fail of producing this effect, and although the evidence on some occasions may appear equivocal, and admit of other special explanations, still the frequent infection after the contact of these, the sequence of occurrences, and the connexion of sensations, conspire to the formation of a well-founded belief that the result is produced in the way usually accredited.

140. *b.* From what I have stated above, I infer that the inoculation of the plague may be effected. That while its accomplishment proves the contagious nature of the pestilence, its failure, for the reasons I have given (§ 96), cannot be justly considered as disproving the contagious property; and that, although the evidence of the communicability of plague by inoculation is not quite complete, it is sufficiently so, viewing it in connexion with other modes of propagation, to warrant the belief that the plague may be communicated in this way also.

141. *c.* That in addition to, and even more frequently than, the infection by contact of persons and clothes, infection is produced by the emanations or effluvia given off from the

sick, and inhaled by the susceptible upon near approach, remaining near or long with the infected, especially in humid and still conditions of the air, and in ill-ventilated apartments.

142. *d.* That the pestilential emanation, or effluvium, is absorbed and retained by bedding, bed, and body clothes, more especially when these consist of animal products; and that, if these articles are shut up immediately, or soon after they have been used by the sick, and excluded from the atmosphere, they may retain this effluvium, and by giving it off upon exposure to the air, they contaminate the surrounding air, and infect the susceptible who may respire the air thus contaminated.

143. *e.* That numerous occasions may occur in which it cannot be determined in which way or through what channel the infection is conveyed, although no rational doubt as to the actual communication of the distemper from one person to another can be entertained, and that in many cases where the distemper appears to be communicated by contact, the proximity necessary to this act brings the susceptible person within the sphere of infection produced by a pestilential effluvium, or emanation from persons or clothes. Hence the experiment made in 1835, in the Hospital Esbeki, at Cairo, on two criminals, who, after having put on the body-clothes of two persons who had recently died of the plague, lay down on their beds, prove infection either by contact, or by the air contaminated by the clothes, which were used and respired by the subjects of the experiments, or by both modes. In these two instances infection was manifested on the fourth and sixth days.

144. *f.* That the period during which either the bodies of the dead or the contaminated clothes may retain the power of infecting the living has not been ascertained, and most probably no particular period can be assigned, as it may rationally be supposed to vary with the physical and other circumstances by which either source of infection is surrounded. There can, however, be no douht that the dead body retains the power of infection during a period of considerable duration, and that the same may be said of the clothes and bedding of the infected, when these have been excluded from the influence of air and light.

145. *g.* That, however we may speculate as to the nature of the specific miasm, effluvium, or emanation propagating plague or either of the other pestilences, we only know actually that it is specific, or of a determinate kind, in each distemper; and that it is so, is an inference the truth of which is demonstrated by its effects, and especially by the fact of its propagating and perpetuating its kind. The effects, as well as other considerations, suggest the belief of a certain grade of vitality and organization in the material given off by the diseased, and affecting the susceptible among the healthy, and consequently of a specific conformation or constitution of the infecting material in each distemper, and they favour, but by no means prove, the idea of infection by the generation of invisible living existences by the diseased, that, either directly or by contact, or mediately, or by the air contaminated by these existences floating in it, affect the healthy in a similar and determinate manner.

146. *h.* That the chief and most frequent channels of infection are the respiratory passages and organs; the air inhaled conveying with it the contaminating or infecting agent, whatever this may be, and thereby infecting the healthy, whenever this agent is sufficient in quantity or concentration relatively to the susceptibility of the person exposed; but that infection may take place in some instances and circumstances from the cutaneous and digestive mucous surfaces, although much more rarely, and merely contingently.

147. *i.* That we have no valid evidence, in respect of plague, more than as regards the other pestilences and the exanthemata, that this distemper may be generated *de novo* hy certain sources, namely, by the emanations from dead animal matter, or from the exuviæ and dead bodies of our own species, although numerous circumstances favour this doctrine, while others militate against it, and support the opinion that the pestilence is perpetuated by contagion and infection, during circumstances favourable to the communication of it; and that it is prevented from being extinguished by the transport of it from one place to another, its existence and prevalence in one or more places, when it has disappeared from others, furnishing the means of its return to those places from which it had entirely disappeared for a time.

148. *k.* That many of the circumstances which suggest the doctrine of spontaneity, or the generation *de novo* of the plague, on occasions of its appearance and prevalence in places where these circumstances exist in the most evident manner, remarkably favour the propagation and perpetuation of the pestilence, and, in fact, constitute the condition which has been denominated epidemic constitution, influence, source, centre, or *foyer;* but they require the presence of the pestilential germ or infection, whether already existing sporadically or endemically, as incorrectly termed, or being latent in certain fomites, or imported from more or less distant places, before the malady can be developed and disseminated.

149. *l.* The period of *incubation*, or the time elapsing from the moment of exposure to the infecting agent to that at which the effects become manifest, has been variously estimated. It evidently varies in duration with the concentration or amount of the dose of infection relatively to the susceptibility of the recipient. It may be so short as not to admit of recognition, as in the occasion of a cart conveying a number of bodies to the pit dug to receive them, when, upon the jolting of the cart, a most overpowering gush of foul air proceeded from the bodies which it contained, and almost instantly struck down a person who was near it, and who died in an hour or two afterward; and the period may extend to ten or eleven days. The period has not been supposed to be longer than this by most of those who have communicated with the French Academy of Medicine on this subject.

150. *m.* That an attack of plague protects from a future seizure as certainly as an attack of smallpox, or of any other of the exanthemata, protects from a second infection. That this fact, fully proved hy Dr. Russell and others, has not been sufficiently recognised by several

recent experimenters; although it is of great importance in selecting attendants on the diseased, and in our speculations as to the propagation, prevalence, and sporadic or endemic existence, of the pestilence, and as to the escape or insusceptibility of many of those exposed to it.

151. *n.* That the occurrence of infection from merchandise or goods, of any other description than clothes and hedding used by the sick, must be very rare, as the circumstances in which these can be infected by plague must necessarily be rare; and even when clothes and bedding are contaminated, exposure for no very long period to due ventilation, especially when the air is dry and the wind is high, will be sufficient to deprive them of any infectious property.

152. *o.* That the various predisposing and accessory or determining causes of plague have not been fully ascertained, and their influence determined farther than may be inferred from what I have stated above (§ 124, 127, *et seq.*); and extremes of temperature, dry states of the air, and free perflation and ventilation always either arrest or restrain the spread of this pestilence.

153. VI. Mortality from Plague.—This pestilence is probably the most fatal of any to which the human frame is liable. At Marseilles, it was believed that above one half of those seized died of it; and in certain places and institutions, the proportion of fatal cases was even higher. Thus, in the "Hôpital de la Charité," 1013 cases were received, and 585 died. In the "Hôpital du Jeu de Meril," 1512 persons were received, and 820 died; and in the lowest classes the proportion of deaths was still greater. As respects the plague of London in 1665, and all the more recent outbreaks of the distemper in other cities and districts, there is no evidence that the mortality has been much less, but we have no statistical information upon which any reliance can be placed. It is very generally remarked that, at the beginning of an epidemic, although the malady is least diffused, it is the most fatal; that, during the increase and height of the pestilence, a larger proportion recover; and that, during the decline, the numbers attacked are much diminished, and the comparative mortality is much less. These facts may be explained on the supposition that, in the early progress of the distemper, the most predisposed to infection are first attacked, and being the most susceptible, are the most liable to sink under it; that, as the sources of infection multiply, the less susceptible are also attacked, but are the least severely affected, and recover in greater numbers; and that, after a certain number of weeks or months, when the distemper has been introduced among a dense population in a town or city, the least susceptible only remain to be infected; and, if these are attacked, they are the most likely to recover, unless they are exposed to a more concentrated infectious effluvium, or have become more predisposed to a severe infection. Hence it often occurs, as noticed by Dr. Russell and others, that some persons, who have been in close communication with the sick, have resisted infection until the decline of the epidemic, when they have been attacked, and even died.

154. The prevalence and mortality of plague depend much upon the numbers of those, in a district where it has been introduced, predisposed to infection. If the distemper has been frequently epidemic there, or has been lately remarkably prevalent, a considerable number of persons protected from a second attack will necessarily exist. The most susceptible of plague, as in the hæmagastric pestilence, has been said to be the young, robust, and plethoric; but this is not fully established, especially as regards the rate of mortality among them, which has also been considered as high. The greater prevalence of the distemper among these persons is probably owing to the greater exposure to infection to which they are liable. The fact of the mortality being the greatest among the negro and dark-skinned races, whose frames are much less powerful than the Caucasian, would indicate a comparatively less mortality among those which are young and strong. The recent observations of the European physicians who have practiced in the East do not appear to confirm the opinions as to the greater liability of, and greater mortality among, robust and young persons; indeed, there is every reason to believe that, however susceptible such persons may be of infection, at least the proportion of recoveries is greatest among them.

155. There is no datum from which any inference can be drawn as to the influence of different modes of treatment upon the mortality of the distemper, more especially during the epidemic prevalence of it among a dense population. The varying characters, severity, and complications of the disease must render any particular method of cure altogether unsuitable to some cases, although most appropriate to others; and thus all exclusive plans or measures must be equally successful, or, rather, abortive, if universally employed. It is in this distemper, as, indeed, in all others, most manifest that the careful adaptation of the means of cure, and the varying and suitable combination of them to existing grades, states, and associations of morbid action, can alone have the effect of so controlling or arresting such action as to influence the comparative rate of mortality.

156. VII. The Nature of Plague.—My views of the nature of this pestilence may be inferred from what has been advanced above respecting the *occasions* and *causes* of its outbreaks, and the phenomena presented by the infected. My remarks, therefore, on this topic are merely a summary of what appears to be, as well as not to be, fully established respecting it.

157. *a.* Plague is a contagious and infectious distemper, according to the meaning attached to these words, both above (§ 58, 59), and in the article Infection, and in the favourable circumstances and states of susceptibility already fully insisted upon (§ 124, *et seq.*); and a person who has been once attacked by it is protected from a second attack, as proved by Russell, White, and others.

158. *b.* The infection of plague may be preserved in, and propagated by, the bedding, bed, and body clothes of those who have been attacked; and the pestilence has been propagated by these means, in the circumstances and states of susceptibility above shown (§ 124, *et seq.*), as well as by personal communication or contact.

159. *c.* Goods, or articles of trade or merchandise, not having been used by the sick, cannot be expected to propagate the distemper in any circumstances, especially if they have been exposed to the air.

160. *d.* The infectious emanation or poison, when received into the lungs during respiration, may so depress the organic nervous energy and vital power of the frame, and so contaminate the circulating fluids, as instantly to produce manifest effects, or even to destroy life in two or three hours, when this emanation is very powerful or concentrated, relatively to the state of vital resistance. When, however, this poison is less powerful, or the infection of the frame differently produced, and when the vital resistance to its morbid impression and contaminating influence is energetic, then a more considerable period is required to develop its operation and noxious effects in a manifest and specific form; but the extreme duration of that period is not precisely ascertained, although it is generally believed not to extend to above eleven or twelve days.

161. *e.* The changes produced upon the healthy by the infecting miasm evolved from the sick are of an asthenic and septic character; and however high the vascular reaction may be, owing to the powers of the constitution—to the vital resistance opposing the poison invading and contaminating the body—there is a tendency to a dissolution of the crasis of the blood, and of the vital cohesion of the soft solids: the capillaries, the lymphatic glands, and the cellular and mucous tissues, early experiencing and manifesting the effects of these changes.

162. *f.* As the phenomena and characteristics of this distemper have been uniform during ages, and in all countries, however far apart, and wherever they have been observed, so it may be presumed that the efficient cause is also uniform and specific, reproducing its kind on all occasions, and with the power of perpetuation *ad finitum*. The distemper being specifically the same in all ages, the cause may be also considered to be of a specific kind, and to be preserved and propagated by the successive infections produced by it, as shown above (§ 103, 104); and although numerous circumstances favour a belief in the generation of this infection *de novo*, or in its spontaneity, still the evidence is not conclusive on this point, and still more numerous circumstances and considerations oppose it (§ 108, *et seq.*).

163. *g.* The characteristic changes of this malady are accompanied by various accidental or adventitious phenomena, arising out of the concentration of the exciting cause or morbid poison occasioning it, of the state of susceptibility of the recipient, and of peculiarity of temperament, constitution, and habit of body; and probably, also, out of the conditions of the digestive, assimilating, and excreting viscera at the time of infection. Hence sometimes appear, in the course of the malady, certain prominent affections, or complications, which may more or less characterize it, in addition to those which are specific and are constant. Owing to this circumstance, J. Frank and others have divided the distemper into certain *states* or *forms*, namely, the *Simple*, the *Inflammatory*, the *Gastric*, and the *Nervous*, according to the predominance of the affections corresponding with these designations. But this division is defective, inasmuch as the most severe and most rapidly fatal cases of the distemper are not comprised in any of the above states, the patient sinking rapidly, owing to extreme and rapidly increasing depression or annihilation of the powers of life, without vascular reaction, or prominent affection of the gastric or cerebro-spinal organs.

164. *h.* It is probable that the circumstances of locality may also modify the type or character of the febrile phenomena of plague—that on occasions of the extension of infection to places productive of emanations from marshes, &c., and at seasons when the malaria from these sources are most abundant, the infection of plague may be attended by either an intermittent or a remittent type of fever. It has been contended, when plague has appeared in such localities, and has presented more or less of a periodic fever, that the distemper has actually originated in the increased concentration or intensity of the malaria generated in these places. But there is no proof of this actually having been the case; but every reason to believe that the distemper had been introduced, and that the existing malaria had imparted to it more or less of a periodic character.

165. *i.* Although it is admitted that the foul air generated by the decomposition of animal substances, and of animal exuviæ, will produce continued fevers of a malignant or putro-adynamic character, especially when decomposition takes place in a warm, humid, and stagnant air; and although it is probable that plague may be thus generated *de novo*, still the evidence of this actually being the case is not conclusive; and we are, therefore, led to infer that, as the distemper is specific or *sui generis*, so is the infectious agent or poison which perpetuates it, however it may have originated (§ 103, 104).

166. *k.* Although the plague presents most of the characters of a malignant or putrid fever in the highest degree, it cannot, therefore, be inferred to be identical with that fever, as some writers have contended, inasmuch as it possesses certain specific signs and lesions which are not present in the latter, and which do not appear in those cases of malignant or putrid, or putro-adynamic fever, which arise from infection.

167. VIII. Treatment of Plague. — The treatment of this pestilence may be said to have been hitherto altogether empirical. The great number of medical men who have, since the commencement of this century, visited the East, and practiced for many years in countries where the plague is most prevalent, have thrown no light upon the cure of it. The introduction of quinine and of the chlorides into practice, during this period, has added somewhat to the means of cure available for the distemper; but the former is merely a preparation of a substance previously in general and even beneficial use in most cases of this pestilence, and the latter has not always been employed in such modes and combinations as are calculated to show the full amount of their virtues. Even popular remedies, such as olive oil, have not received that attention from European physicians which their reputation among the Arabian doctors might have excited. Indeed, the perusal of accounts

of the numerous means resorted to against this distemper, from the beginning of the sixteenth century down to the present day, leaves the humiliating and lasting impression on the mind, of the very inefficient and contemptible nature of most of them, when we compare what is known of the operation of these means upon the economy, with the obvious nature and remarkable severity of the changes characterizing the distemper. It must be most manifest to all who endeavour to combat the changes and morbid conditions constituting a malignant disease, and who attempt to employ agents appropriately to pathological states inferred to exist, that those agents should neither be doubtful as to their operation, nor be of a trifling kind as to their effects—that they should possess energetic and determinate properties, and be employed so as to produce a decided operation; and that the activity and the combinations of the means should be directed with strict reference to the remarkable depression of vital power throughout the frame, and to the poisoned condition of both fluids and soft solids characterizing this malady. But have the means employed against this pestilence possessed these attributes, or been prescribed with due reference to morbid conditions, or in those modes and combinations which could rationally admit of any hopes of a beneficial result from their exhibition? I can safely answer that, in 99 cases out of 100, where the means resorted to have been described in connexion with the states of the case for which they were prescribed, that no such hopes could be rationally entertained, and that, if any advantage actually did accrue, it was due to the efforts of nature, to the innate vital resistance to morbid changes, and not to the agents employed. Of the treatment of plague, the most important part is that which relates to *the protection of the community from its introduction*, and *of individuals from its infection, after it has been introduced*. This will, however, be discussed in the sequel, when considering the means of protection applicable to this and the other pestilences (*see* Pestilences, general and individual Means of Protection from); and I now proceed to discuss *the curative treatment of this distemper*.

168. i. Curative Treatment of Plague.—I have sufficiently insisted, in the foregoing pages, on the necessity of removing all affected by malignant diseases into a pure air, and into a large, well-ventilated apartment, whenever this can be accomplished; and it is the more especially required for cases of this pestilence, and more particularly for those attacked in close, crowded, and low situations. But this removal should be effected with a due regard to the protection of the healthy, and to the limitation of the pestilence. Persons who have already had the disease should be employed about the sick in preference to others, and personal cleanliness should be strictly enforced. There is nothing which tends more, as regards not only this, but also the other pestilences, to increase the infectious property, than the use of soft beds, especially those stuffed with wool or feathers, of woollen bed-clothes, and the neglecting frequently to change the night and inner body-clothes. There is every reason to believe that the entire disuse of bedding and coverings, consisting chiefly of woollen or other animal materials, in countries liable to outbreaks of pestilential distempers, would tend much to prevent the diffusion of infection.

169. *A.* At the commencement of an attack, *emetics* have been much recommended both by the older and more recent writers. M. Aubert states that, in the more benign cases, they were always followed by an abatement of the symptoms, and generally by recovery, which would take place without farther treatment, but then convalescence was prolonged; that he never observed any unpleasant effects from them in any circumstances; and that, in the more dangerous cases, the progress of the distemper was often arrested for a time by them, thereby giving time to act, and the patient was not weakened by them, as by bleeding. He, therefore, regards emetics as most beneficial early in the disease, in all cases. M. Aubert, however, offers no remarks as to the emetics which should be preferred. But it is obvious, from the nature of the malady, that a preference ought to be given to those which are least likely to lower the powers of life, and that these should be conjoined with stimulants, or warm aromatics. Thus, *sulphate of zinc* may be prescribed with capsicum, camphor, ginger, cinnamon, &c., and *ipecacuanha* either with these, or with ammonia and aromatics. Dr. Hodges very justly remarks, that the dose of the emetic should be large enough to operate soon, and to evacuate the stomach completely; that it ought to be given only in the infancy of the distemper, and not when the stomach has been freely evacuated by the retchings which often accompany the more full development of the malady, and that antimonial preparations are not advisable.

170. *B. Blood-letting* has been considered injurious in the plague by the great majority of both old and modern writers. Sydenham, Dover, and a few others have, however, advised large blood-letting; but the former possessed not the experience of his contemporary Hodges, who strongly opposes this practice; and the disease for which Dover employed copious bleedings was not the true plague. Hodges observes, with much justice, that "if the authority of the ancients, as well as the experience of the moderns, have any weight, and, indeed, if my own practice may be regarded, it is highly to be feared, from many instances, that bleeding in a genuine pestilence is not only to be suspected, but charged as pernicious." MM. Aubert and Rigaud had recourse to blood-letting in Europeans, for whom they believed it to be sometimes of use; but they considered it as generally injurious in the Arab constitution. M. Dulong states, that the violence of the fever, and the imminent congestion of some important organ, induced him to have early recourse to venesection, and sometimes even to repeat it. Generally an amendment immediately followed the operation, but it was of short duration, and he rarely obtained any signal advantage from the practice. He, however, found the application of *leeches* behind the ears, when the head was prominently affected, or upon the epigastric region, when the digestive organs were remarkably disordered, to be of considerable service.

171. Massaria believed that blood-letting was beneficial in the plague of Vicenza in

1576; and he was considered by his contemporaries as a great authority. Opinions, however, greatly preponderate against this practice; yet, in some cases, especially among the nations of northern and temperate climates, in young, robust, and plethoric persons, and in the sanguine temperament, a moderate vascular depletion, early in the distemper, may be of service, and may dispose the system to be more readily influenced by diaphoretic and restorative remedies. In cases such as these, Sydenham recommended venesection to a large amount, and even to be repeated; but, when he found the practice opposed by the patients and their friends, he confided chiefly in a moderate blood-letting, and followed it immediately by full and frequent doses of warm diaphoretics.

172. *C. Sudorifics* appear to have received the favourable testimony of almost all writers on this pestilence. Diemerbroeck, Van der Hoyde, Sydenham, Orræus, Russell, Chenot, Pugnet, Desgennettes, and many others, trusted chiefly in them, selecting those of a warm and stimulating kind.—*a.* Dr. Hodges remarks, that all authors and practical physicians agree in this, namely, to throw out the pestilential poison as soon as possible by warm sudorifics, or *Alexipharmics*, according to the nomenclature of the day. It would be of little advantage to notice the numerous and very diversified substances which he recommends for this purpose; but among these are to be found some of the most energetic substances which are employed at the present day. He adds, "that recourse should be speedily had to these remedies as to a sacred refuge; and there is such plenty of them, that nature seems to have had more than an ordinary indulgence and forecast in providing them against this destructive enemy of mankind." Of these remedies, he considered the *Virginian Snakeroot*, with much justice, "the most efficacious diaphoretic and Alexipharmic for expelling the pestilential poison." And the next place he believed to be due to the *Contrayerva-root*, which, as well as the snakeroot, he combined with a number of other vegetables of a stimulating and aromatic nature, in every conceivable form—in powder, electuary, infusion, decoction, &c.

173. *b.* Of *mineral sudorifics*, there is none so safe and efficacious as the one first introduced into practice by Minderer, and so long known by his name—the Spirit of Minderer, or *liquor ammoniæ acetatis;* and, when given with the *ammonia* very considerably in excess, it is more to be depended upon—more febrifuge and diaphoretic, especially in all low, pestilential, and exanthematous fevers, than any other medicine with which I am acquainted. In all these maladies, and especially in plague, it may be conjoined with the *infusion of serpentaria*, or with the *decoction of bark*, or with *camphor*, or with all these, when the powers of life are much depressed, and unable to resist the poisonous tendency of the infection on the frame: but in such cases the ammonia should he also greatly in excess, unless the urine indicates an ammoniacal tendency, when the *aromatic acetic acid* may be substituted, and it be allowed to be in excess.

174. *c.* Many years ago, frictions of the surface with warm *olive oil* was much recommended by Baldwin and others in the treatment of plague, with the view of promoting a copious sweat, which seldom failed of supervening. The practice was common in the East from the earliest times; and the oil was also taken internally with the belief of its possessing both prophylactic and curative properties. Several experienced writers are much in favour of it, and the evidence is very conclusive as to its diaphoretic operation when employed externally; but it is by no means so as to its curative influence, yet even in this way it appears sometimes to have been of use. Mr. Jackson, in his account of the very destructive plague which was introduced into Morocco in 1799, recommended it to many, both as a preventive and as a cure; and he states in both characters it was eminently successful.

175. *D. Purgatives* have been found generally injurious by most writers on this pestilence. Bockel states that they were remarkably so in the plague of Hamburgh in 1565; and Palmarius, Demerbroeck, and Russell, as well as most recent authors, have been equally decided in the reprobation of them. It is evident, however, that the moderate evacuation of the morbid secretions and excretions is not so much dreaded by them as the disposition existing in most cases of the distemper to diarrhœa, and the difficulty of limiting the operation of purgatives to a moderate evacuation, and of preventing inordinate and exhausting discharges from the exhibition of them. It must be obvious that the evacuation of accumulated secretions and excretions from the bowels, and the prevention of any collection of these, are most important objects in the treatment; but they should be attempted hy such mild agents as are most readily controlled, and the least liable to excite irritation, in the weakened and already irritable intestinal mucous surface. It is extremely probable, that *olive oil*, when used internally as well as externally, produces a mild demulcent, or soothing, as well as laxative effect on the bowels, without occasioning an operation of an exhausting kind, or one which is not readily restrained by the other remedies usually employed against the malady. Although much employed as a popular remedy, it has not received that attention from the regular members of the profession which I think that it deserves, from my knowledge of its effects in several other diseases. Judging by analogy, and guided by other considerations, I would advise the occasional combination of the *oleum terebinthinæ* with this oil, and the exhibition of it both by the mouth and in enemata, according to the circumstances of the case; guarding, at the same time, their action by means of *aromatics*, *spices*, and small doses of *opium*, or of camphor with opium.

176. *E. Stimulants*, *tonics*, and *antiseptics* have been generally employed against plague, and are more applicable to it than to any other malady. Indeed, I much doubt the propriety of withholding them in any state or stage of the distemper whatever, even where vascular excitement appears the most violent. The vascular reaction often occurring at an early period of the malady is of that open and expansive kind which indicates greatly reduced vital power in connection with morbid action; and it will certainly be found that no more in

this distemper than in other malignant diseases similarly characterized, can this action be subdued without restoring, as far as may he, vital power, and enabling it to resist those changes by which this action is excited and perpetuated. In fact, the same principles, upon which I insisted when discussing the treatment of the *hæmagastric pestilence* (§ 178, *et seq.*), should also be adopted in this. Even in cases of the most violent vascular action, and when it may be prudent to have recourse to a moderate or full blood-letting, the stimulating diaphoretics already noticed, with full or even large doses of the *sesquicarbonate of ammonia*, or of *camphor*, or of the *sulphate of quinine* and *camphor*, should be prescribed as frequently as the urgency of the case may require. Sir A. Brooke Faulkner states that in two instances a large quantity of *spirits of turpentine* and of *camphor* were taken by mistake, and that both recovered.

177. *a.* The remarkable loss of tone throughout the vascular system, in this as well as in the preceding distemper, prevents the vessels from accommodating themselves to the quantity of blood in the system, and creates a demand upon the heart to support the circulation by means of greatly increased action; hence, in the great majority of such cases, even a moderate blood-letting is often detrimental, inasmuch as it still further increases the loss of that due correspondence which should exist between the state of the blood-vessels and the amount of blood circulating in them, unless, indeed, the depletion be immediately followed by the exhibition of stimulants or tonics; and of those, the most to be depended upon are *camphor*, *quinine*, *ammonia*, with or without the *liquor ammoniæ acctatis*, the preparations of *serpentaria*, or of *arnica*, the *hydrochloric ether*, &c. Of all these, *camphor* and *ammonia* are the most generally of service; and the former is congruous with any other remedy which may be employed; but it should be prescribed in full or in frequent doses. The *sulphate of quinine* has been very favourably mentioned by most recent writers; but it has only taken the place of the *cinchona bark*, which was formerly much used in this distemper, with serpentaria, ammonia, and other stimulants. It will he found that the combination of the *quinine* with *camphor* and *capsicum*, and the exhibition of all three in full doses, will prove most decidedly beneficial, especially during the earlier stages of the malady.

178. *b.* When *irritability of stomach* prevents the due exhibition of stimulants or tonics, or the retention of them, an *epithem* of warm spirits of turpentine should be applied over the epigastrium; and this will generally allay the retchings, if it be properly applied, and remarkably aid in bringing out and promoting a most copious perspiration. In this state of the distemper, which J. Frank denominates the *gastric form*, effervescing draughts are generally grateful. Dr. Russell is in favour of the use of these, but those of the carbonate of ammonia, with either the citric or the acetic acid, the ammonia being considerably in excess, should be preferred; and such restoratives and antiseptics as the circumstances of the case may suggest be prescribed, from time to time, and chiefly in enemata when the stomach still continues irritable. About a drop of *creasote* may be given with each dose of the medicines; and several drops of this substance may be added to the enemata, especially when diarrhœa is present.

179. *c.* At an *advanced stage* of the distemper, or from the commencement of the attack in cases presenting much depression and other signs of malignancy, the more energetic stimulants and tonics recommended for similar states of the *hæmagastric pestilence* (§ 179, *et seq.*) may be resorted to, as being quite appropriate to these cases. Indeed, whenever vital depression is very remarkable, the stimulants prescribed ought to be such in kind and quantity as will produce an immediate effect; and the selection of them should he guided by the previous habits and circumstances of the patient. Several of the stimulants in more general use are also *antiseptics*, and these should be given in full, and even large doses, especially those mentioned above (§ 176, *et seq.*). But they ought not to be deferred until a too far advanced period of the disease, but should be prescribed early, especially in the more malignant or septic cases, and given in decided doses and in efficient combinations. It does not appear, from the recent works on plague, that the *chlorides* have been employed in it in such a manner as fully to test their efficacy, and in such combinations as are most likely to prove beneficial. The most appropriate of these is probably the *chloride of lime*, conjoined with camphor, aromatics, and opiates. The *chlorate of potash* also promises to be of service, especially when prescribed in stimulating or tonic infusions or decoctions, particularly the infusion of *cusparia*, or of *serpentaria*, or of *cloves*, or of *valerian*, or the decoction of *cinchona*, or of *senega*, or *tormentilla*, and with various other restoratives and aromatics. The *hydrochlorate of ammonia* was formerly much employed in low fevers; it is equally suitable for this malady, and it may be taken with any of the substances just mentioned, in as large doses as the stomach will tolerate, or from ten to twenty grains. Its good effects will generally be promoted by the addition to each dose of from half a drachm to a drachm of the *hydrochloric ether*. Various formulæ for the medicines recommended at this place will be found in the Appendix, more especially *Form.* 385, 387, 388, 409, 416. 431, 437, 439, and 848, which may be prescribed in quantity and frequency of dose according to the severity of the disease.

180. M. Aubert states that he gave *phosphorus* in many cases of this distemper; but it does not appear that any decided benefit was derived from it. The formula for it in the *Appendix* (428) is a suitable mode of employing it in this disease. This physician mentions a new medicine, called *hachisch*, which he considers of great efficacy in this malady. He furnishes no information as to the nature of this substance, but states that several cases recovered by its aid, which he considered altogether hopeless before it was administered. He gave it in doses of one, two, or three drachms in coffee; and it appears to have had a stimulating and exhilarating effect.

181. *F.* At the commencement of the present century, the *affusion of cold water over the surface* was considered the most successful and

most generally appropriate remedy in all fevers, especially those of a severe or malignant form. Experience has shown the very exaggerated estimate then formed of this practice. It was at that time recommended for plague as well as for other pestilential maladies; but observation and reflection have shown that, unless where the vascular reaction was high, and the heat of the surface was much increased, and at the early period of reaction, the practice was sometimes injurious, and often of doubtful advantage. I can find no evidence of its having proved of service in this distemper; although it is probable that it may, in those cases which are characterized by more violent vascular reaction, and which have, from this circumstance, been by some viewed as presenting an inflammatory character, advantageously precede the frictions of the surface with olive oil (§ 174) that have generally been found so beneficial in bringing out a copious perspiration.

182. *G.* The very general recourse which was formerly had to *mercurials* in the cure of fevers by British physicians, more especially to *calomel*, was extended also to the plague; but the diarrhœa, which is so apt to come on in the course of the malady, restricted their use; and their effects, in any form, appear to have been equivocal. The trials, however, made of them by Mr. STAFFORD, as related by Sir B. FAULKNER, seem to indicate that they deserve a farther and a more satisfactory trial. Calomel and mercurial inunction were the means employed, with the view of producing their specific effects. They have been, also, recommended by SCHREIBER, FORMAY, SCHRAUD, and others; but, as OLIVIER has observed, the system resists the specific effects of all mercurials in the severe cases, and the slight cases do not require a recourse to them. If calomel should be employed, it ought to be conjoined with opium and aromatics, to prevent it from disordering the bowels; and even when thus combined, this effect may nevertheless ensue.

183. *H. Diarrhœa* is one of the worst symptoms which occur in the course of the distemper, and is generally controlled with great difficulty, especially when it appears at an advanced stage. At an early period, *opium*, conjoined with camphor, creasote, and aromatics, will frequently restrain it; but the more active *astringents*, conjoined with *antiseptics*, will often be required, more especially the *chloride of lime*, the *sulphate of zinc*, conjoined with *catechu* or *kino*, &c., and with opiates. These substances should also be administered in enemata.

184. *I.* The treatment which has been fully described as most beneficial in the hæmagastric pestilence is in most respects suitable to this, the several means of cure being varied according to the form which the malady assumes. Many of the distinctions, however, which have been pointed out by writers will hardly be made out in practice; and, though they may be prominent in some cases, they will hardly appear in others. It will be sufficient for the physician to bear them in mind, to adapt his measures to the features of each case which may come before him, whether *inflammatory*, *nervous*, *gastric*, *putrid*, or *septic*, according to the views of various writers; to act upon pathological principles; and to employ his remedies conformably with their ascertained effects.

185. *K.* As to the *local treatment* of the *bubocs* and *carbuncles*, little farther is required than the application of poultices, fomentations, or emollients, as their states may require. When matter or other fluid accumulates, an exit should be given to it, in order to prevent the contamination of the adjoining tissues, and a healthy suppuration ought to be promoted. Subsequently the healing process may be encouraged by means of such digestive and gently stimulating applications as the cases will suggest. The condition, however, of these sores will be much more efficaciously controlled by the internal or constitutional treatment than by local applications; and in most cases it will be necessary to support the powers of life, when the external lesions are considerable, in order that the process of restoration may go on satisfactorily.

186. *L.* The *diet* and *regimen* of the patient should be the same in this as in other fevers. Indeed, the diet and regimen which are suited to this pestilence are also suitable for the others, especially the *hæmagastric*. At an early period of the attack, especially when febrile reaction is considerable, and the disease assumes that form which has improperly been denominated the inflammatory, owing to the vital resistance and vascular disturbance, simple diluents, and refrigerant and diaphoretic drinks, are the most serviceable; but in a more advanced stage, or in more protracted cases, and where the vital powers are depressed, a more restorative diet may be allowed, as chicken, veal, or mutton broths, beef tea, &c., which may be taken with sufficient salt and spices to render them palatable; and as the distemper advances, and vital depression increases, wine, brandy, or liqueurs may also be taken, diluted in various ways, or in arrow-root or sago. In this distemper, as well as in the hæmagastric, hock or sherry, with Seltzer-water, Champagne, brandy in the warm infusion of black or green tea; the bitter Hungarian and Austrian wines; milk or green tea punch; the yolk of an egg beat up in brandy and water or sherry; various kinds of jelley, &c., may be severally given, according as the circumstances of the case will suggest to the physician a guarded recourse to them. There is every reason to believe that in this malady, as well as in other low fevers, the use of these and similar dietetic restoratives is often too long deferred, and that the cravings of the patient for them are very improperly unheeded. In the diet and regimen, as well as in the medical treatment, of patients in low or malignant fevers, the physician has been too often guided by prevailing theories and doctrines, instead of proceeding warily in the path of close observation and sound common sense. With these as his guides, while he endeavours to fulfil the intentions rationally inferred from recognised states of morbid action or of altered structure, the physician will generally act safely and efficiently; and will produce as successful results in this as in other distempers, as can possibly be produced by the limited amount of human means and of human intellect.

187. *M.* The *management of convalescence* should depend upon the circumstances in which the patient is placed, and be ordered accordingly. The chief points which require attention

are the enjoyment of a pure air and due ventilation; suitable diet; and the due promotion of the several digestive and excreting functions. During this period, care should be taken that the extent of the external sores, or the amount of the discharges from them, should not exhaust the patient, or cause a too protracted recovery. The constitutional powers, in such circumstances, often require the aid of both medical and dietetical restoratives; and these should not be timidly withheld, or too profusely allowed. At this time a healthy atmosphere is remarkably beneficial; and as soon as the patient can bear removal to a different air, the change will prove the greater restorative; but this must be done with due precautions and regard to the health of the uninfected.

Bibliog. and Refer.—*H. Stainhowel*, Regiment der Pestilenz, 4to. Ulm, 1482.—*A. Benedetti*, Liber de Observatione in Pestilentia, 4to. Venice, 1493, and folio, Bologna, 1516.—*P. de Bayrus*, Questio nova de Peste, 12mo. Taur., 1507.—*J. Vochs*, De Pestilentia Anni Presentis ejusque Cura, 8vo. Magd, 1507.—*F. Bernardus*, Tract. de Origine et Causis Morb. Pestilent., 4to. Colon., 1518.—*J. Schillerus*, De Peste Britannica Commient., 12mo. Basil, 1530.—*J. B. Gemma*, De Vera Ratione Curandi Bubonis Carbunculisque Pestilentis, 4to. Dant., 1549.—*T. Gibson*, A Treatise behovefull to preserve the People from Pestilence, 4to. Lond., 1536.—*N. Massa*, De Febri Pestilentiali, Petechiis, Variolis, et Apostematibus Pestilentialibus, ac eorundem Curatione, &c., 4to. Venice, 1536, 1556.—*G. Gratarolo*, Pestis Discriptio, 8vo. Lyon., 1555, 12mo. Paris, 1561.—*J. Dalechamps*, De Peste, libri tres; et *R. Chalin De Vinario*, Liber de Peste, 12mo. Lyon., 1553.—*G. Agricola*, De Peste, Libri quinque, 8vo. Bâle, 1554.—*B. Landi*, De Origine et Causa Pestis Patavinæ, Ann. 1555, 8vo. Ven., 1555.—*V. de Bounagente*, Decem Problemata de Peste, 8vo. Ven., 1556.—*A. Gallus*, Fasc. de Peste et Peripneumonia cum Sputo Sang. Febri Pestilentiali, &c., fol. Brescia, 1565, et 12mo, Francof., 1608.—*J. Houllier*, De Morb. Curatione, de Febribus, de Peste, &c., 8vo. Paris, 1565.—*T. Beza*, Tract. de Peste, 12mo. Ludg., 1565. Translated into English by *J. Stockwood*, 8vo. Lond., 1580.—*L. Joubert*, De Peste Liber, &c., 12mo. Lyon., 1566.—*O. de Oddis*, De Peste, et Pestiferorium Adfectuum omnium Causis, Signis, Præcautione et Curatione, Libri iv., 4to. Veneta, 1570.—*B. Patinius*, De Venenis, Sive Morbis Pestilentialibus, 8vo. Brix., 1572.—*B. Pisanelli*, Discorso Sopra la Peste, 4to. Roma, 1572.—*J. P. Ingrassias*, Informazione del Pestifero e Contagioso Morbo, il quale affligе ed ha afflitto la Città de Palerme, e moltre ultre Città e terre del Regno de Sicilia, nell' Anni 1575 et 76, 4to. Palerme, 1576.—*J. Bokelius*, De Peste Hamburgensi, 12mo. Hurricop., 1577.—*C. Johnson*, Counsell against the Plague, 8vo. Lond., 1577.—*T. Brasbridge*, The poor Man's Jewel, a Treatise on the Pestilence, 8vo. Lond., 1578.—*A. Perez*, Tratado de la Peste y sus Causas, 8vo. Madr., 1598.—*J. Bamford*, A short Dialogue concerning the Plague's Infection, 8vo. Lond., 1600.—*J. Mercuriali*, De Pestilentia in Universum, præsertim de Veneta et Patavina, 4to. Venet., 1577, et 4to, Leyd., 1601.—*G. Potel*, Discours des Mal. épidemiques ou Contagieuses Advenues à Paris en 1596, 1597., 1606, et 1607; comme aussi en 1619, 8vo. Paris, 1623.—*J. Palmarius*, De Morbis Contagiosis, Libri vij. Paris, 1577.—*A. Massaria*, De Peste, Libri ij., 4to. Venet., 1579.—*J. Camerarius*, Synopsis quorumdam brevium, sed perutiliem Comment. de Peste Clariss. Vir. *Donzellini, Ingrassiæ, C. Rincii*, et post hoc sui ipsius eadem de lue Scripta in lucem retulit, &c., 8vo. Nuremb., 1583.—*F. Alexandri*, Trattado della Peste e Febbri Pestilenti, 4to. Torino, 1586.—*P. Alpinus*, De Medicina Ægyptiorum, Libri iv. Veneta, 4to, 1591; lib. i., cap. xiv.–xviij.—*R. de Castro*, Tract. brevis de Natura et Causa Pestis quæ, Anno 1596, Hamburgensem Civitatem afflixit, 4to. Hamb., 1596.—*T. Lodge*, A Treatise of the Plague, 4to. Lond., 1603.—*J. Godskall*, King's Medicine for the Plague, 8vo. Lond., 1604.—*A Gallus*, Fascis Aureus de Peste, 12mo. Francof., 1606.—*G. Garnevus*, Επιτομη, &c., De Peste quæ Grassata est Venetiis, Anno 1576, &c., 12mo. Brunt., 1610.—*F. Rondinelli*, Relazione nel Contagio Stato in Firenza l'Anno 1630 et 1633, 4to. Florence, 1634.—*D. Sennert*, De Peste, Pestilentialibusque ac Malignis febribus. In Opp. Omnia. T. V. Lib. iv., 4to. Francf., 1634.—*M. A. Rota*, De Peste Veneta, Ann., 1630, 4to. Veneta, 1634.—*J. Ripumonti*, Libri v. de Peste quæ fuit Ann. 1630, in Urbi Mediolanensi, 4to. Milan, 1631.—*J. De Lemprière*, Traité de la Peste, de ses Causes, &c., 8vo. Rouen, 1620.—*Th. Thayne*, An excellent and best-approved Treatise of the Plague, 4to. Lond., 1625.—*W. Roraston*, A Treatise of the Pestilence, 8vo. Lond., 1630.—*R. Lyonnet*, Loimographia seu Reconditarum Pestis Causarum Curiosa Disquisitio, 8vo. Lion., 1639.—*J. Woodfall*, The whole Works of, containing a Treatise on the Plague, fol. Lond., 1639.—*S. Bradwell*, Physick for the Sicknesse called the Plague, 4to. Lond., 1636.—*J. de Diemerbroeck*, De Peste, Libri iv., 4to. Amh., 1646, et Amsterd., 1665.—*Van Helmont*, Tumulus Pestis, 4to. Amsterd., 1648.—*P. de Castro*, Pestis Neapolitana, Romana, et Genuensis, Ann. 1656 et 1657. Fideli Narratioое Delineata, &c., 12mo. Verona, 1657.—*L. Giesseler*, Observat. Medicæ de Peste Brunsvicensi, Ann. 1657, 4to. Brunsw., 1665.—*J. B. Bindt*, Loimographia seu Hist. Pestis Contagiosa, 4to. Roma, 1658.—*Anon.*, Certain necessary Directions concerning the Plague, 4to. Oxf., 1665.—*Anon.*, Golgotha, or a Looking-glass for London, showing the Causes, &c., of the Plague, 4to. Lond., 1665.—*J. Gadbury*, London's Deliverance predicted, showing the Causes of the Plague, &c., 4to. Lond., 1665.—*T. Garencieres*, A Discourse concerning the Nature of the Plague, 4to. Lond., 1665.—*T. Sydenham*, Febr. Pestilent. et Pestis, Ann. 1665, 1666; Opera Medica, sect. ii., cap. 2.—*N. Hodges*, Λοιμολογια, sive Pestis nuperæ apud Populum Londinensem grassantis, Narratio Historica, 8vo. Lond., 1672; transl. by *Quincey*, with additions, 8vo. Lond., 1720—*G. Harvey*, A Discourse of the Plague, 4to. London, 1665.—*W. Kemp*, A Treatise of the Nature, Cause, Signs, and Cure of the Pestilence, 4to. Lond., 1665.—*W. Austin*, The Anatomy of the Pestilence, a Poem, 8vo. Lond., 1666.—*G. Thomson*, Λοιμοτομια, or the Pest Anatomized, 12mo. Lond., 1666.—*P. Barbette*, Tract. de Peste, cum Notis, *F. Dickeri*, 12mo. Lond., 1667.—*E. Gockel*, Enchiridion de Peste, &c., Aug. Vin., 8vo. 1669.—*L. J. Bimius*, Pestis ad Vivum delineata et Curata, Leod. Eb., 12mo. 1671.—*J. J. Quatroux*, Traité de la Peste, de la Difference de la Pourpre, la Petite Verole, et la Peste, 8vo. Paris, 1671.—*C. La Font*, Dissert. duæ de Veneno Pestilenti, 12mo. Amst., 1671.—*H. Brunswick*, Liber Pestilentialis, Buch der Vergift der Pestilenz, fol. Strasb., 1700.—*L. Pereira de Beinterna*, Loimologia, sive Historia Constitut. Pestil. Ann. 1708, 9, 10, 11, et 13, per Thraciam, Sarmatiam, Poloniam, Silesiam, Daciam, Hungariam, Livoniam, Daniam, Sueciam, Saxoniam, Austriam, variaque loca grassante, &c. Vienna, 1714.—*J. B. Werlosching a Parenberg*, Loimologia, seu Hist. Pestis quæ ab Anno 1708 ad 1713 inclusivé, Transylvaniam, Hungariam, Austriam, &c., aliasque Conterminas Provincias et Urbes, prægrediendo depopulabatur per Epistolas ex Autopsia et Experientia propria medica exarata. Styria, 1716.—*J. C. Gottwald*, Memoriale Loimicum de Peste Dantiscana, Ann. 1709; Dantzick, 1710.—*M. Stoeckel*, Anmerkungen bey der Pest, die Ann. 1709, in Dantzick Grassante. Hamb., 1710.—*J. Browne*, Practical Treat. of the Plague and all Pestil. Affect. that have happened in this Island for the last Century, 8vo. Lond., 1720.—*Anon.*, The Causes of the Discontents in relation to Plague, 4to. Loudon, 1721.—*R. Mead*, A short Discourse concerning Pestilential Contagion, 8vo. London, 1720.—*Anon.*, Some Observat. on the Plague, occasioned by Dr. *Mead's* Discourse, 8vo. Dubl., 1721.—*Anon.*, Collection of valuable and scarce Pieces relating to the Plague of 1665, 2d ed., 8vo. Lond., 1721.—*J. Browne*, Antidotaria, a Collection of Antidotes against the Plague and other Malig. Diseases, 8vo. London, 1721; Considerations on the Nature, Causes, and Cure of Pestilences, by a Freethinker, 8vo. London, 1721.—*R. Blackmore*, A Discourse on the Plague, with an Account of Malignant Fevers, 8vo. Lond., 1721.—*Anon.*, A Succinct Account of the Plague at Marseilles, 8vo, 1721.—*Anon.*, A brief Journal of what passed in Marseilles, afflicted by the Plague in 1720, 8vo. Lond., 1721.—Peste de Marseilles et Provence; Pièces Historiques sur la, en 1720, 21, et 22, 8vo, 2 tomes; repub. Paris, 1820.—*J. Astruc*, Sui l'Origine des Maladies épidemiques, principalement de la Peste, 8vo. Montp., 1721.—*J. B. Bertrand*, Relat. Histor. de la Peste de Marseilles, en 1720, 12mo. Col., 1721.—*R. Boulton*, A Treatise on the Plague, 8vo. Lond., 1721.—*R. Bradley*, The Plague at Marseilles considered, 8vo. London, 1721.—*R. Brookes*, A History of the most remarkable Pestilential Distempers that have appeared in Europe for Three Hundred Years past, 8vo. London, 1721.—*Chicoyneau*, Observat. et Reflex. touchant la Nature, les Evenemens et le Traitement de la Peste de Marseilles, 12mo. Lyons and Paris, 1721.—*W. Henley*, Loimologia Sacra; A Discourse on the Plague, 8vo. London, 1721.—*B. Ramazzini*, De Peste Viennensi, vide Opera.—*T. X. Benza*, Relatio Historica Pestis Austriam aliquando Vastantis, 8vo. Vien., 1717.—*E. Timon*, De Peste Constantinopoli grassanti. In Philosop. Trans. Anno 1720, p. 14.—*Chicoyneau*, *Verney*, and *Soulier*, A Succinct Accouut of the Plague at Marseilles, translated by a Physician, 8vo. Lond., 1721.—*G. Pye*, Two Discourses of the Plague, 8vo. Lond., 1721.—*Anon.*, A new Discovery of the Nature of the Plague, and the true Causes of its raging in European Cities, with the Remedy, 8vo. London, N. D. (*about* 1721. *Generated and propagated by minute insects*).—*J. Pringle*, Rational Inquiry into the Nature of the Plag., 8vo. Lond., 1722.—*C. Scarborough*, Practical Method for the Cure of the Plague in 1665, 8vo. London, 1722.—*R. Mead*, De Peste Liber, 8vo. Lond., 1723.—*J. Astruc*, Dis-

sert. sur la Contagion de la Peste ; ou l'on prouve qui cette Maladie est véritablement Contagieuse, &c., 8vo. Toulon, 1724.—*J. Boecler*, Recueil des Observat. qui ont été faites sur la Maladie de Marseilles, 4to. Strasb., 1726.—*D. W. Triller*, De Carbone Pestilenti Epistolæ, 4to. Uratisl., 1736.—*J. F. Schreiber*, De Peste quæ Annis 1738 et 9 in Ukrania Grassata est, 4to. Petr., 1741.—*W. U. Waldschmidt*, De Peste Holsatica. In *Halleri* Disput. Med., vol. v., p. 547.—*R. Goodwin* An Historical Account of the Pl., &c., 12mo. Lond., 1743.—*Anon.*, The Plague no Contagious Disease, 8vo. Lond., 1744.—*T. Lobb*, Letters concerning the Plague, 8vo. Lond., 1745.—*O. Turriano*, Memoria Historica del Contagio della Città di Messina dell' Anno 1743, 12mo. Naples, 1744.—*D'Autrechaux*, Relation de la Peste de la Ville de Toulon. Toulon, 1721, 12mo. Paris, 1756.—*M. Mackenzie*, Several Letters concerning the Plague at Constantinople ; in the Philosophical Transactions for the Year 1752, p. 384–514, 1764, p. 69.—*W. Hird*, Remarks on Pestilence and Pestilential Diseases, 8vo. London, 1753.—*D. Ingram*, An Historical Account of the several Plagues since 1346, 8vo. London, 1755.—*R. Manningham*, A Discourse concerning the Plague and Pestilential Fevers, 8vo. Lond., 1758.—*A. Bruce*, Inquiry into the Cause of Pestilence, &c., 8vo. Edinb., 1759.—*F. L. Meltzer*, Beschreibung der Pest., 1770–72, in Moscau, 8vo. Moscow, 1776.—*A. Chenot*, Tract. de Peste, 8vo. Vienna, 1766 ; et Historia Pestis Transylvania, &c., Annis 1770, 71, opus posth. edict. *F. de Schraud*, 8vo. Bude, 1799.—*De Hacu*, In Rut. Med., Part xiv., sect. 2, 1770.—*Samoilowitz*, Memoire sur la Peste qui, en 1771, ravagie l'Empire de Russie, surtout Moscou, &c. Paris, 1783.—*C. de Mærtens*, Observat. Medicæ de Febribus Putridis, de Peste, Nonnullisque aliis Morbis, 8vo. Vienna, 1778 ; Translated by *G. Pearson*, 8vo. London, 1799.—*G. Orræus*, Descriptio Pestis quæ Anno 1778 in Jassia, et 1771 in Moscua grassata est, 8vo. Peters., 1784.—*G. Bajamonti*, Storia della Peste che regno in Dalmazia, 1783–4, 8vo. Venez., 1785.—*W. Henderson*, A few Observ. relative to the Things which are probable respecting the Plague, 8vo. Lond., 1789.—*J. M. Minderer*, Comment. de Peste, eique medendi Methodo in ratione et Experimenta fundata, 4to. Riga, 1789.—*P. Russell*, A Treatise on the Plague, containing an Account of the Plague of Aleppo, 4to. Lond., 1791.—*J. Antes*, Observat. on the Manners, &c., of the Egyptians, and on the Plague, 4to. Lond., 1800.—*J. Tytler*, A Treatise on the Plague and Yellow Fever, 8vo, 1799.—*J. V. von Hildenbrand*, Ueber die Pest, &c., 8vo. Wien., 1799.—*J. P. Papon*, De la Peste, ou Epoques mémorables de ce Fléau., 2 tomes, 8vo. Paris, 1800.—*N. Webster*, A brief History of Epidemical and Pestilential Diseases, 2 vols., 8vo. Lond., 1800.—*W. Falconer*, An Essay on the Plague, 8vo. Bath, 1800.—*G. Sotira*, Mémoire sur la Peste Observée en Egypte, 8vo. Paris, 1802.—*Savaresi*, Mémoire sur la Peste, &c. Dans son Recueil de Mémoires Physiques et Médicaux sur l'Egypte, 8vo. Paris, 1802.—*J. Larrey*, Mém. sur la Peste, &c. ; dans Mém. de Chirurg. Milit., t. i., p. 316.—*R. Wilson*, Hist. of the Brit. Exped. to Egypt, 4to, 1803.—*J. Macgrigor*, Medical Sketches of the Expedition to Egypt from India, 8vo. Lond., 1804, p. 100.—*R. Desgenettes*, Histoire Medicale de l'Armé d'Orient., 8vo. Paris, 1802.—*P. Assalini*, Observat. on the Plague, &c., of Egypt, &c., 18mo. Lond., 1804.—*R. Pearson*, A Brief Description of the Pl., 8vo. Lond., 1813.—*J. F. X. Pugnet*, Mém. sur les Fièvres de Mauvais Caractère du Levant et des Antilles, 8vo. Paris, 1804.—*C. Maclean*, The Plague not Contagious, or a Dissertation on the Source of Epidemic and Pestilential Diseases, 2d ed., 8vo. Lond., 1800 ; and Results of an Investigation respecting Epidemic and Pestilential Diseases, including Researches in the Levant concerning the Plague, 2 vols, 8vo. Lond. 1817.—*V. Morea*, Storia della Peste di Noja, 8vo. Naples, 1817.—*G. M. de Richter*, Geschichte der Medicin in Russland, &c., 8vo. Moscou, 1813, t. i.—*R. Grohman*, Ueber die in Jahre 1813, in Bucharest herrschende Pest., 8vo. Leipsic, 1816.—Report from the Select Committee of the House of Commons appointed to consider the Doctrine of Contagion in the Plague, fol. Lond., 1819.—*A. B. Granville*, A Letter, &c., on the Plague and Contagion, &c., 8vo. Lond., 1819.—*J. B. Faulkner*, Treatise on the Plague, 8vo. London, 1820.—*R. Calvert*, Of the Plague of Malta in 1813, in Trans. of Med. and Chirurg. Society of London, vol. vi., p. 1.—*J. D. Tully*, The History of the Plague as it lately appeared in the Islands of Malta, Gozzo, Corfu, &c., 8vo. London, 1821.—*J. Hancock*, Researches into the Laws and Phenomena of Pestilence, including a Medical Sketch and Review of the Plague of London in 1665, 8vo. London, 1821.—*C. Balme*, Observat. et Reflex. sur les Causes, les Symptoms, et le Traitement de la Contagion dans differentes Maladies, et spécialement dans la Peste d'Orient. et la Fièvre Jaune, 8vo. Paris, 1822.—*J. Frank*, Doctrina Pestis, in Praxeos Med. Univers. Præcepta, pars i., vol. ii., sect. 1.—*Vaidy*, Dict. de Sciences Médicales, Art. Peste, t. 41.—*Lachaise*, Sur la Peste en Egypte, dans Bullet. de l'Acad. Roy. de Méd., t. i., p. 354.—*Ozanam*, Historia Médicale de Mal. épidémiques, vol. v.—*F. E. Fodéré*, Leçons sur les Epidémics, et l'Hygiène Publique, 5 tomes, 8vo. Paris, 1824, t. iv., p. 167.—*J. Hennen*, Sketches of the Medical Topography of the Mediterranean, &c., 8vo. London, 1830, p. 501.—*Brown*, Cyclop. of Pract. Med., vol. iii., p. 352.—*D. Barry*, On the Gibraltar Epidemic, in Med. and Phys. Journ. of Lond., vol. lxiv., p. 383 ; and vol. lxvi., p. 476.—*Chollet*, Mém. sur la P. qui a regne epidémiquement à Constantinople en 1834, et sur sa Non-contagion, 8vo. Paris, 1836.—*A. Brayer*, Neuf Années à Constantinople, Observat. sur la Topogr. de cette Capitale ; la Peste, les Causes, &c. ; et la Non-contagion de cette Maladie, &c., 2 tomes, 8vo. Paris.—*Estiennes*, Journ. des Connaissances Medico-Chirurg., Feb., 1837.—*Pariset*, Mém. sur les Causes de la Peste, et sur les Moyens de la détruire, 12mo. Paris, 1837.—*J. F. C. Hecker*, The Epidemics of the Middle Ages. Trans. by *B. G. Babington*. (Published by the Sydenham Society.) 8vo. London, 1844.—*L. A. Gosse*, Relation de la Peste qui a régné en Grèce en 1827 et 8, 8vo. Paris, 1838.—*A. F. Bulard*, de la Peste Orientale, d'après les Matériaux recueilles à Alexandria, au Caire, à Smyrne, et à Constantinople, pendant des Années 1833 à 1838, 8vo. Paris, 1839.—*L. Aubert*, De la Peste ou Typhus d'Orient. Documens et Observations recueilles pendant les Années 1834 à 1838, en Egypte, en Arabie, sur la Mer Rouge, en Abyssinie, à Smyrna et à Constantinople, 8vo. Paris, 1840.—*E. Littré*, Art. Peste, dans Dict. de Médécine, 2d edit. Paris, 1841.—*A. B. Clot-Bey*, De la Peste Observée en Egypte ; Recherches et Considerations sur cette Maladie, 8vo. Paris, 1840.—*Prus.* Rapport à l'Acad. Roy. de Médécine sur la Peste et les Quarantaines, fait au nom d'une Commission, &c., 8vo. Paris, 1846.—*A. White*, A Treatise on the Plague, &c. ; and on Quarantine, 8vo. London, 1846. *This important work, the result of much experience, appeared as this sheet was going to press. It contains numerous additional proofs of the truth of the doctrines for which I have contended.*

PESTILENCES—Protection from.—Having considered the three destructive pestilences of modern times, in respect of their causes, propagation, nature, and treatment, as fully as my limits have permitted me, I now proceed to notice the measures which should be taken to protect the community from them, and the prophylactic means which may be used by individuals against them. In order that the subject may receive due attention, I shall discuss it according to the following *arrangement :*

I. Protection of the General Community from Pestilence.
  i. Prevention or Warding off Pestilence:
    A. By sanatory measures having reference to the state of the locality, and to the community.—Prevention of domestic causes.
    B. By measures intended to prevent the introduction of pestilence from abroad.—Prevention of foreign causes.
  ii. The Arrest of the Spread of Pestilence when introduced or prevailing.
    A. When introduced or prevailing in towns, cities, &c.
    B. When introduced among troops, armies, or garrisons.
    C. When introduced into ships.
II. Protection of Individuals, Families, or Classes.
  i. Protection by Seclusion, or strict Quarantine, &c.—Departure from the Sources of Infection.
    A. Estimate of the means answering this protection.—The avoidance of infection.
    B. Restrictions which should be imposed on those departing from an infected locality, and when they should be imposed.
  ii. Protection by such Means as may enable the Constitution to resist Infection.
    A. Medicinal Prophylactics.
    B. Dietetic, Regimenal, and Moral Prophylactics.

2. I. The Protection of the general Community from Pestilence.—The objects of gov-

ernment, in all civilized countries, are the protection of the lives and properties of the inhabitants, the observance and advancement of religion and morals, and protection from foreign aggression. For the attainment of these objects, laws are enacted and enforced. In most of the countries of Europe, however, the last of these objects have received the greatest attention, and to it the wealth and resources of countries have been more especially devoted. The lives of the inhabitants have always attracted the smallest amount of regard from governments, legislators, and political economists; and even from those who administer the laws, unless under circumstances of peculiar atrocity. The numerous circumstances which influence the health and longevity of the community; the palpable causes which produce disease and pestilence; the acts of individuals or of companies, affecting the health or lives of hundreds or thousands of those with whom they have intercourse or concerns, or who surround them; and the multifarious modes in which avarice and the love of over-reaching directly and indirectly sap the springs of life, have never engaged the attention of most governments, and least of all, those of this country, until the magnitude of these evils, the fears of a widely-spread pestilence, and the pressure from without, diverted a very small portion of that attention to them which had heretofore been entirely absorbed by the interests of parties and the advantages of a class. Formerly, and even now, although much less remarkably, literature, in attempting to live upon the crumbs which fell from the tables of placemen and aristocratic partisans, like the parasite gull, so well known to the naturalist, fed only on the offal and filth ejected by those whom she worshipped. The sufferings of the poor, the squalor consequent on want and misfortune, and the garbs necessary to the satisfactory performance of important and requisite occupations, were made the themes of poetic derision and prosaic sarcasm by the statesmen and the popular writers of the day! Yet, however foul and degraded the Georgian era of literature may have appeared in several of its epochs, science continued to advance with due majesty, and with a gracious care of the health and lives of those who had become the least cared-for parts of the machinery, invented for the acquisition of wealth, and who were looked upon by statesmen as the common herd, among which pestilence and death might freely revel, as "checks to an overgrown population." Philanthropy went abroad; but, in neglecting his home, most signally destroyed or enslaved the objects of his foreign care. His very enthusiasm blinded him to the effects of his actions, and diverted him from his domestic duties; but hopes of his return are to be entertained from certain measures which public opinion has enforced, and he may still promote some of the numerous reforms of our social condition that are urgently required, and remove many of the most influential causes of disease and of premature dissolution that degrade while they afflict the community.

3. i. The Prevention of, or Warding off, Pestilence.—It is obviously the duty of governments, however much they may neglect it, *to prevent pestilence from springing up* in the countries they profess to protect, and *to ward off the invasion of pestilence from abroad*. These are two grand sanatory intentions, the fulfilment of which the community has a right to demand from those who govern and enormously tax it. The second of these has been as efficiently and satisfactorily accomplished as circumstances allowed; but the first has been altogether neglected; and not merely neglected, but sacrificed to class interests. No efforts have been made by those who had the power, but neglected the duties which that power involved, to prevent the habitations of the living, the depositories of the dead, and the aggregations and conditions of the lower animals, from becoming the sources of disease or pestilence. The ignorant builder, who, in many instances, could hardly write his name was in no way discouraged from building houses and streets calculated to endanger not only the health of their inmates, but that also of the whole neighbourhood. He might erect houses and streets in any form and position, at the shortest possible distance, with the utmost disregard of ventilation, and without either drains, cess-pools, or sewers. He might favour the accumulation of animal exuviæ as much as he pleased, and in as detrimental a mode as possible to the health of all within many hundreds of yards, and no one could interfere. He might introduce disease and death among the whole population of his district, and, instead of meeting with reprehension from the authorities, obtain the reputation of being a spirited proprietor, and accordingly receive a portion of the mammon-worship so generally and so assiduously performed in almost every street, mansion, and house in the kingdom. The capitalist economizes his means by the neglect of sanatory measures, which would necessarily involve expense, and the law protects him in doing what he pleases with his own; but it does not deign to protect the lives of those around him from the certain consequences of his ignorance and avarice. Thus London, and most other cities and towns in the kingdom, have increased in size without the least control, or the smallest endeavour to protect the public health; but, on the contrary, with every facility to accomplish the deterioration of it, and with the strongest inducements, in the acquisition of wealth, and hence of consideration, to generate disease. These remarks may be considered overstrained; but let the reader refer to the evidence brought before the "*Health of Towns' Commission*," and published in its reports, and he will find them inadequate to convey the opinions which the numerous circumstances and occasions there described must suggest.

4. A very able and enlightened member of that commission, Mr. J. R. Martin, observes with great justice in reference to this subject, that, "if it be the business of government to prevent and to punish crime—to secure the public peace—to enforce industry instead of rapine—and the settlement of disputes by appeal to reason instead of by fraud or violence; if the well-being of the subject be, in short, the main object of legislation, then would it appear the special duty of the ruling power to secure the health and the lives of those who, of all others, stand most in need of its protec-

tion against the invasions of individual or corporate caprice, ignorance, or stolid avarice. Here we perceive a moral and political duty of necessity. On this subject it should ever be borne in mind that, where there is disease, there also will be found the seat of poverty and crime. Disease, poverty, and crime in their worst forms are constantly and everywhere found together. The truth then is, that misery and crime produce disease, and disease produces misery and crime, in a circle which revolves in the same calamitous monotony from year to year, of the brief existence of the masses crowded in the worst quarters of our manufacturing cities. While men are in the lowest state of physical destitution, surrounded by filth, vermin, privation, and squalor of every conceivable kind—familiar with sickness and death, and strangers to every comfort—with the mind continually on the rack, or absorbed in striving against physical necessity—or with the animal spirits broken down by its pressure, how is it to be expected that obedience to the laws, and that morals, education, or religion should find a place? How can a man whose mind is ruined even more effectually than his body—the man to whom moral degradation and physical suffering have done their worst—how can such a man be expected to give a passing thought even to such matters? The thing is impossible."

5. But, not to speak of these higher considerations, the benefits of surrounding civilization, cleanliness and health, are not for the occupants only of lanes, courts, cellars, and houses, tecming with exhalations from the excretions and other exuviæ of the inhabitants, but extend in various ways to the inmates of mansions, and even palaces—to the houses of the rich and the proud—to the dwellings, and even to the persons, of those who consider poverty and wretchedness the worst of crimes, and who cannot approach even the one or the other, even in the temples of the Almighty, even in the houses of that God whom they profess to worship, without dreading contamination, and derogation from their high positions.

6. *A. The prevention of the generation of pestilence or disease in a country* has been already insisted upon as a duty which the government owes the community. The neglect of it is sure to become the source of calamity, and the extent of that calamity will neither be readily controlled nor soon arrested, at least on all occasions of its occurrence. In this climate the calamities arising out of the sources to which attention is now to be directed are generally not so prominent as in warmer countries and places, where the progression of the seasons is more regular; but if, owing to the nature of our seasons, they are less remarkably violent, they are more numerous and varied, and they can he shown to be equally destructive in their silent, constant, and unobtrusive course.

7. It must not he supposed that, because the causes of disease to which particular reference is about to be made, and has been made, in various parts of this work, and particularly in connection with the pestilences just considered, have not heen proved to be the originators of any of these pestilences in this country, they are, therefore, entirely without influence as respects either the propagation of these pestilences when introduced, or tne production of other not less fatal, although more prolonged, maladies. They are, in truth, among the most efficient causes of the diffusion and propagation of all infectious maladies; while they are the principal agents in the generation of chronic and constitutional diseases, in contaminating the springs of life at their very sources, and in producing decrepitude and mental weakness in the offspring, if, indeed, the blighting influence of these agents during infancy and childhood be survived.

8. *The prevention of domestic causes of pestilence is also the prevention of epidemic maladies, and of numerous chronic and constitutional diseases.* The prevention of those causes has no farther relation to the three pestilences above considered than as respects the removal of some of the chief circumstances which favour and give activity to the infection of these pestilences, on the occasions of the introduction of the infection from abroad; but it has a much more certain, continued, and manifest effect upon the prevalence of the numerous other maladies, which, in our climate, depend upon their domestic causes, especially as they exist in large towns and cities. These causes are so evident to the senses, so disgusting to the sight, so sickening and sensibly injurious to all who come within their spheres, and so very prominently connected with their baneful effects, that it is a matter of the utmost surprise that a more enlightened attention to them, and attempts at their removal, have not long since heen enforced by the legislature.

9. *All sanatory measures which should be enforced in a locality* should have for their objects, 1st. The removal of the excretions, as speedily as possihle, from the habitations of the people, and the prevention of their accumulation; 2d. The means or method of their removal should be such as should, as efficiently as possihle, prevent the escape of the gaseous and putrid emanations they emit into the atmosphere; 3d. That a sufficient supply of water should be provided for the rapid removal of putrid exuviæ and excretions, and for other purposes of cleanliness and ablution; 4th. That animal remains and excretions should as quickly as possihle he conveyed to their natural and intended destination, namely, to cultivated fields and soils, with the intention of fertilizing them; 5th. That the bodies of the dead should not become, from the mode of sepulture, and the situation and crowded state of the places of burial, with reference to the habitations, especially in cities and towns, a source of disease to the living; 6th. That ditches and marshes should be removed, especially in the vicinity of animal and human habitations, by under-draining, &c.; 7th. That while the supply of water should he ahundant, it should in no way he contaminated hy the vicinity of burial-grounds, ditches, or marshes; 8th. The supply of pure air, and the requisite renewal of it in all circumstances, with as little risk of contamination as possible from animal excretions or remains—from drains, sewers, cess-pools, church-yards, ditches, marshes, &c. In proportion as attention is paid to these topics, so will the health of cities and towns be improved. But I cannot dismiss the consideration of them without further and more particular notice.

10. *a. The prevention of animal excretions and remains from accumulating*, especially in large towns, has always been attended with some difficulty, but it is a difficulty which has rarely, until very recently, been attempted to be removed. Indeed, much more frequently, if not almost universally, actual provision has been made in large cities and towns for the accumulation of these excretions to a most astonishing amount, and without any intention of their removal for many years. It was proved before the "Health of Towns' Commission," that these accumulating sources of disease exist in respect of most of the houses of all cities and towns, in the forms of privies attached to houses unconnected with drains, and of cess-pools, into which the soil from water-closets and privies, and the foul water used for domestic purposes, flow; and that these cess-pools, privies, and drains exist under and around most of the best residences, and in all the worst, in and about London, and in other cities and towns, and that they have generally no communication with the common sewers and drains, but actually are allowed to accumulate until their overflowing contents compel a recourse to nightmen.

[This remark will apply particularly to the city of New-York, which has, undoubtedly, better natural advantages, and is more favourably located for health, than almost any city on the globe. Though abundantly supplied with the purest water—the *Croton*—yet it has no extensive system of sewerage; and, indeed, it is but very recently that sewers have begun to be constructed at all, and that only in our principal streets; while privies and cess-pools have no communication with those already made, their contents being discharged by nightmen, with the effect of contaminating whole neighbourhoods with the most horrible stench. When to this we add, that filth of every kind is allowed to accumulate in our streets and gutters, which are rarely washed, although there is ample water to accomplish it; that slaughter-houses and manufactories of various kinds, delcterious to health, abound in every part of our city, it will be seen that reform is loudly called for, if we mean to keep pace with other cities in guarding the lives and health of our citizens.]

11. The inhabitants who have for so many years calmly submitted to a heavy sewer-rate, from the notion that the sewers formed by their contributions actually carried away the soil and foul water from their houses, now find that they have been deluded, legally swindled; and that, notwithstanding the vaunted drains and sewers of the metropolis, there is no necessary connection between them and the houses, close to which they pass, even where they do pass; that the sewers are few compared with the number of streets, and that comparatively few houses have any communication with them. Thus the contents of privies or necessaries, water-closets, cess-pools, and drains, are allowed to sink into the soil upon which the houses are built, to poison it, and to contaminate the air within and around the dwelling, the more consistent remains being pent up, and allowed to accumulate without any outlet whatever. As these contents collect and increase, the more fluid parts filtrate through the upper layers of earth or clay, and contaminate the water supplying pumps and springs. The gaseous parts, and those which are carried off during evaporation by the air, more or less infect the air, and destroy the health in various ways, of those especially who live in the lower apartments, and particularly if they sleep in them. During warm seasons the emanations proceeding from these accumulations of animal excretions, and from the ground thus imbued with animal matters, upon and around which the dwelling stands, become almost as injurious as those generated in warmer climates and countries, to which reference has been made above, in respect of the generation of the pestilences just now considered; and would, equally with them, promote the diffusion of the infection of those pestilences as soon as the infection should be imported. Indeed, the accumulated emanations thus arising from the aggregation of individual sources, furnished by thousands of residences, constitute that contaminated state of atmosphere which favours the propagation of the infection of these pestilences; and the absence of these emanations, or at least the comparative absence of them in country places, partly accounts for the much slighter prevalence of pestilence in these localities.

12. It is supposed that the circumstance of cess-pools and drains, containing animal matters in a state of decay, being covered over, is a sufficient protection from their injurious influence. But they are not hermetically sealed. There is a constant generation and extrication of foul gases from them; and these gases, and the air contaminated by them, are continually passing off between the boards and crevices of the stones which cover them. In many places of this metropolis, as well as in manufacturing towns, large privies exist, used by the numerous workmen in large and crowded factories; and cess-pools of immense extent, which receive the contributions of many houses and work-shops. It is well known that the former are often not emptied for many years, but are allowed to diffuse their odours, and their baneful influence, for many hundreds of yards, in all directions; and it is stated of the latter, that an attempt was made to empty one of them, situated in a central and crowded neighbourhood; but after some scores of cart-loads of soil were removed, the rods which were employed to reach the bottom of the depository were not sufficiently long for the purpose, and the Herculean task of emptying it—cleansing was out of the question—was relinquished. It was stated, also, before this commission, that one of these immense reservoirs of filth and putrid animal matter existed immediately under a school, so that, in addition to the contamination of the air by the congregation of a great number of children in a confined and insufficiently ventilated space, there was the additional evil of foul air constantly rising up from the poisonous sources beneath them.

13. Much has been said of the collections of filth, of the superficial uncovered drains, and other disgusting states of things in former times; and in numerous continental and eastern cities and towns in modern times; and of their influence in originating and perpetuating pestilence. But these sources of mischief are

readily swept away by rains; the emanations from them are soon dissipated hy the winds; and the grosser materials are carried off and devoured by birds of prey and the lower animals; so that they are actually less injurious than those accumulations of filth and fæcal matters furnished by almost every house in the towns of this country. These fæcal collections are so carefully preserved from these natural means of purification, that the emanations from them continue to he generated at all seasons, and to be extricated within the very walls of the dwelling, in their areas, and under the very windows which are intended to admit fresh air and light. No cold in this climate is so great as to prevent the generation of noisome vapours and gases from these sources; while the warmth of summer and autumn increases the extrication of them, and concentrates them in a more humid atmosphere. But it may be asked hy utilitarians and political economists, where is the mischief which these admitted nuisances and offences against the senses occasion? Do they produce pestilence? We see no sign of pestilence. To these every well-informed physician will answer, that there has been no pestilence—no plague—because the seminium or infection of plague has not been allowed to be imported. But if it had been imported, or were even now to be imported, especially during summer or autumn, all the conditions requisite to its devastating spread exist in the sources now pointed out. Although protected from this foreign scourge by quarantine laws, the existence of which is now threatened by persons ignorant of the subjects to which they relate, let it not be supposed that these nuisances, these sources of contamination, are unproductive of the most serious effects. To the question, therefore, as to the mischief they occasion, another may be put, as to what mischief, evil, or disease afflicting the human frame may not be imputed more or less to these very remarkable domestic sources. I find it much more difficult to point out a single disorder or malady which cannot be imputed partly or altogether to these causes, than to enumerate the many which acknowledge them as their principal sources. Even where they are not the efficient agents, as in the pestilences above considered, they are predisposing, aiding, and determining causes. They more especially occasion sickness and death during infancy and childhood; and even when these epochs of human existence are struggled through, and the various affections of the digestive organs and nervous system, and the febrile diseases, and the varied forms of debility which these causes produce, are either partially or altogether removed, there frequently succeed a sickly period of puberty, impaired manhood and premature decay, scrofula, and tubercles in their numerous forms and seats, visceral diseases in countless variety, and mental weakness in endless forms and grades.

14. During the present warm summer (1846), I have had numerous occasions of remarking the very injurious consequences of frequenting those privies in which the fæcal matters are allowed to accumulate. Of three families, every person was attacked with adynamic dysentery, with a low or putrid form of tenesmus, and an erysipelatous state of the anus, extending to the vulva and vagina of the females. In one family, nine persons were thus attacked; and in several other families, and on other occasions, I have traced these affections, which have often heen attended by great danger, to this particular cause—to the influence of the foul and concentrated effluvia, from long-accumulated fæcal matters, upon the mucous surface of the anus and vagina.

15. It is obvious from this that no such accumulations of noxious agents should be allowed to exist; that drains and sewers should be so constructed as to convey from the dwellings, as rapidly as possible, and without sinking into the soil, or evaporating into and contaminating the atmosphere, the foul materials and animal exuviæ into the main sewers; that the supply of water should be sufficient to aid this object, and that the main sewers should be so constructed, as respects their terminations, as to allow their contents to be removed by safe and suitable modes of conveyance, to cultivated grounds for the purposes of manure.

[This is a very important measure, which we trust will not be disregarded in the future sewerage of our cities. Wherever a proper system of house-drainage prevails, the valuable excreta of the human frame, containing the debris of all the food consumed by the inhabitants, find their way into the sewers. Experience has proved that these excreta, but especially the urine, are among the most effective of our manures; and that they far exceed in value the products of the farm-yard and all solid manures, not even excepting *guano*. In China, and those parts of continental Europe where agriculture is most skilfully practiced, this fertilizing liquid is highly valued.

To this, the most important constituent of sewer water, may be added, as derived also from house-drainage, the alkalies, potash, and soda, which are so largely used for household purposes in the form of pearlash, soap, and common salt. These alkalies form, as is well known, very important elements of the food and structure of plants. Besides all these, we have the refuse of slaughter-houses, markets, and manufactories, large quantities of soot, rich in ammonia and sulphurous acid. So valuable are these debris of towns, that it is calculated that a population of 100,000 in number would furnish sufficient nitrogen, phosphoric acid, and other substances to manure no less than 93,440 acres of wheat; and in Flanders, we are informed that the excreta of an adult are valued at ten dollars per annum. Lands in England which were formerly a barren waste have been known to yield as much as £11 4*s*. per acre annually.]

16. *b. The burying of the dead within, under, and around chapels or churches, or in large burying-grounds, situated within, or close to cities or towns*, is among the most serious evils of the present state of society, and of existing legislation. The emanations from these places are equally injurious with those proceeding from the sources just noticed, and are, on some occasions, as I have often witnessed, even more strikingly injurious, owing to the greater concentration of the noxious vapours and gases, especially as they emanate from the remarkably crowded burying-grounds and vaults around and under chapels in the metropolis. And, although numerous states of ill-health and forms

of acute disease actually proceed from this cause, as well as from that above exposed, the most malignant putrid or putro-adynamic fever, as described under that article, have come before me, and been referred to this source by the more intelligent of those who have been thus attacked. I have, moreover, had demonstrative evidence that cases of this fever, caused by the emanations from the vaults of chapels in this city, and terminating fatally in eight days from the period of exposure, these emanations at the moment of their impression producing most marked effects, have infected other persons, in the same house with them, with a similar and equally dangerous and fatal fever.

17. The congregation of many hundred persons in a building, opened only once in the week, warmed and ventilated but partially and imperfectly on that occasion, and containing immediately beneath its floors, and surrounded by, thousands of human bodies undergoing putrefaction and decay, must necessarily prove more or less injurious to health; and still more remarkably to the health of those who may happen to inspire a portion of those irruptions of foul air which break forth at intervals from the burying-places, or which flow from the grated openings communicating with the vaults and other places of sepulture constructed under the pews of these chapels.

18. *c.* It is almost unnecessary for me to insist upon the *impropriety of allowing ditches, swamps, or marshes to contaminate the air* in the vicinity of towns, or any human habitation whatever; or to bring supplies of water from places near to these sources of disease, or to burying-grounds. Water loaded with animal matters in a state of decay, or abounding with animalculæ, and the infusoria, is most remarkably productive of diarrhœa, dysentery, mucous and adynamic fevers, or of those typhoid forms of fever which are attended by ulceration of Peyer's and Brunner's glands. The means of removing these causes are too obvious to require notice at this place, and ought never to be neglected, although no very remarkable mischief may result from them, or no very remarkable outbreak of disease may occur. They, nevertheless, impair the constitutional powers of all within the sphere of their influence; induce, gradually and slowly, visceral obstruction, and numerous chronic maladies, and favour the prevalence by promoting the infection of malignant and pestilential distempers.

19. *d. Crowded apartments and assemblies, and neglect of due ventilation of these, and of the dwellings of the poorer classes*, are among the most productive causes of disease, and of the diffusion of pestilence, wherever pestilential infection is introduced. The residences of the poor are not merely overcrowded, but also ill-ventilated, owing both to the prejudices of many of this class, and to the situation of them in courts, lanes, narrow streets, and cellars. A free and thorough ventilation is often impossible in these situations; and, in addition to this cause of disease, and to the evils resulting from large numbers residing and sleeping in each of the several apartments into which the house may be divided, there are often superadded the foul air proceeding from privies, cess-pools, and drains, and the other sources above described (§ 9, *et seq.*). Thus the air which is respired by persons thus circumstanced is contaminated both by those who breathe it and by the several causes just alluded to; and in this state of contamination it is allowed, moreover, to stagnate, to become still more foul, and to concentrate more fully the emanations from the bodies of those who respire it, and from the several sources above indicated. Among persons thus placed, it must be expected that all infectious maladies will not only make rapid progress, and prevail extensively, if not generally, but assume a more malignant character than in other and more favourable circumstances.

20. It is not, however, merely by favouring the extension and malignancy of infectious and pestilential maladies that these causes act injuriously on the classes of the community more especially subjected to them, but also by actually generating infectious diseases, and even by imparting an infectious character to several affections which would not otherwise present it. In this way fevers are generated, and are spread from these original sources to the abodes of wealth and rank—to the very families and persons of those by whom the wants of the lower classes were neglected, for they could not have been unknown, and to whom they were an abomination; for, if they had been objects of compassion, they would have been long since considered with the intention of devising a remedy for such of them as admitted of remedy.

21. The want of due attention to ventilation in the construction of work-houses and other places for the reception and medical treatment of the poor, aided by insufficient and unwholesome food, has been no mean cause of the production of low fevers, diarrhœa, and dysentery among the inmates of these places, but also of the prevalence of these diseases in the vicinity. The crowded states of these abodes of poverty and disease, and the several other sources of disorder connected with them, certainly do not limit their baneful effects to the places in which they exist, but extend their malign influence on many occasions by various modes of infection, in several directions, and to more than one class of the community. If a rigid inquiry were made by competent persons into the states of work-houses, lunatic asylums, charitable institutions, chartered and endowed schools, penitentiaries, and other places where a constant residence or daily congregation of a number of persons or of children is required, how few would appear unexceptionable in every respect. In many, ventilation is imperfect or only partial; in others, the sleeping as well as the sitting apartments are most disgustingly overcrowded; in most of them imperfect ventilation is associated with over-crowding, and not infrequently, also, with foul emanations from privies, cess-pools, and drains; in some, one or more of these ills are conjoined with insufficient and unwholesome food, and with want of due exercise in the open air; and in not a few, all these evils are combined in various states, according as one or several of them assume more or less prominent characters, or are, moreover, associated with neglect of cleanliness of person and of residence, &c. In what condition could the inmates of a lunatic asylum

have been in, as respects all the circumstances which contribute to health, and especially those to which attention has been directed above, when 112 out of 450 died in twelve months, as proved by Mr. Wakley in the House of Commons?

22. *e.* There is nothing which tends more to injure health, and to develop scrofulous and tuberculous and other chronic diseases among children and young persons *than numbers sleeping in the same apartment.* The evil is great in proportion to the number relatively to the size and imperfect ventilation of the chamber; but when this is conjoined with others, as it often is, more particularly with foul emanations from privies, cess-pools, and drains, with insufficient or unsuitable food, and with insufficient exercise in the open air and in sunshine, the injuries thereby inflicted upon the constitution in various forms of acute as well as chronic disease, and the malignancy and danger imparted to infectious and febrile distempers, when they break out in these circumstances or places, become the most alarming, and often the most hopeless, to which medical aid can be called. The circumstance of numbers being compelled to sleep in the same chamber has been fraught with mischief, not only to the physical powers and the bodily health, but also, and not less remarkably, to the moral feelings and dispositions through life; and although most especially detrimental to children and young persons, it is also very seriously injurious to grown-up people. What is the state of health in children in large schools and institutions, where from five or six to fifty or sixty children sleep in the same apartment; the smaller numbers in boarding-schools, and the large number in public institutions, as Christ's Hospital School at Hertford? The data necessary to a correct answer to this question are not before me; but I will assert, from no small experience of the bad effects of this and other conditions of these schools and institutions, as favouring the development and spread of disease, that the extent of the mischief thus produced is not even suspected by those who are most actively concerned in their management. The evils which result from causes connected with the arrangements of these institutions are even not seen, and when they are seen, from their prominence or extent, they are not referred to their actual sources.

23. Nor are some of the evils which may be traced to the congregation of great numbers of children during the day in small school-rooms much less remarkable than those above adverted to; but when it is known, as indeed it has been proved before the "Health of Towns' Commission," that these assemblages, of several hours' duration, actually take place in rooms immediately over immense cess-pools, or in chapels streaming with emanations from the dead bodies in their vaults, or from those putrefying around the walls, or from both productive sources, it may, without great impropriety, be assumed, that the wisdom of man, even of him who thinks himself the most divinely inspired, is but blindness, foolishness, and presumption; and that, in his attempts to accomplish what is laudable in itself, he is actually occasioning acute disease, or contaminating the constitution during life, and occasioning, moreover, that state of contamination which will be imparted to the offspring during many generations. The collection of numbers of persons in factories, the imperfect ventilation of many of them, and the modes of warming and lighting them, are not among the least of the evils to which the health of the working classes is exposed. Science could not render a greater service to the community than in rendering her aid to the reformation of these and similar ills, which weigh upon the physical and moral powers of the productive classes; and affect equally their health, happiness, and offspring.

24. *B. The Prevention of foreign Pestilence.*—The duty of government to prevent the introduction of pestilence from abroad is as obvious as that to prevent both the existing and predisposing causes of pestilence, and of distempers almost as fatal as pestilence, from being generated and allowed to exist at home. While the former has been entirely neglected in this country, the latter has received a very proper attention. Yet, although the neglect of all domestic sanatory measures has met with little reprobation, the enforcement of the quarantine laws has experienced much opposition; and restrictions of every kind, calculated to hamper commercial speculations, have been condemned by those who consider a small pecuniary loss of greater importance to them than the contingent occurrence of a great public calamity. But, as Mr. M'Culloch justly remarks, "quarantine is not a matter in which innovations should be rashly introduced; whenever there is doubt, it is proper to incline to the side of security." In this country we have to guard against the introduction of the three great pestilences above considered, and the risk from each, although remote, is probably almost equal. The frequent importation of plague into this and other European and northern countries, before the institution of sanatory measures; the increased risk occasioned by the very rapid communication between all parts of Europe and those places in the Levant and within the tropics, where plague and hæmagastric fever prevail, and our recent experience of the pestilential cholera, are circumstances which should not be overlooked in our estimate of the probabilities of a visitation from either of these distempers, and which ought to influence those who are bound to protect the public, while they give every facility in their power to trade, in their deliberations and enactments.

25. In the United States, more especially in some of them, and in many of their large commercial cities, quarantine has been either imperfectly enforced, or not instituted at all, until recently. The great distance between them and the Levant, and the nature of their climate, gave them little cause of alarm as to the introduction of plague; and, until lately, the hæmagastric pestilence, so generally and destructively prevalent in the West Indies and on the coast of Mexico, and so frequently epidemic in some of their chief cities, was viewed entirely as a domestic evil, against which quarantine and other sanatory measures could not possibly prove of any avail. From 1751 until 1791, this pestilence made its appearance in New-York on several occasions; but after the latter period it appeared more frequently and more destructively, as might have been expected from

the increased size of and population of the city and the more frequent intercourse with places where it prevailed. It even occurred during two or three successive years, and was seldom absent for a longer period than this, until 1822, when it prevailed most fatally. Since that year quarantine regulations have been strictly enforced, and the distemper has not appeared again in that city—now a period of nearly a quarter of a century—although it has scarcely been a year absent from vessels detained in quarantine, and in the quarantine hospital. (See *the Report of a Committee of the House of Assembly of the State of New-York on the present Quarantine Laws.* 8vo. Albany, 1846.)

[It seems no more than proper to state that the yellow fever did not prevail in New-York between the years 1805 and 1822, when, whatever quarantine regulations may have existed, were by no means strictly enforced, a fact which may serve to shake the soundness of the conclusion arrived at hy our author. It seems to us, moreover, that in accounting for the exemption of the city from this disease since 1822, it is hardly proper to attribute it entirely to the observance of strict quarantine; for, during the same period, vessels have been freely allowed to come to the wharves at Brooklyn, after two days' quarantine, and discharge their cargoes, and yet no yellow fever has been propagated in that city from this source, nor has infection spread from vessels unladen at the quarantine station, nor from yellow fever patients received into the hospital at Staten Island from sickly ports. It should be borne in mind that the general sanatory condition of this city has materially improved within the last twenty years, by prohibiting the burial of the dead in the crowded parts of the city; widening and cleaning streets; and the introduction of the Croton water, &c., so that it is now the opinion of our most enlightened physicians that, even were the yellow fever to be introduced, it would not spread, owing to the absence of those atmospheric conditions on which its extension seems to depend.]

26. Can any stronger proof of the propriety of enforcing these regulations be adduced than that to which I have now referred, and which may he perused with numerous other valuable documents in the official report just named? It is well known to most physicians that Dr. Rush, celebrated not only as a medical writer, but as a statesman, at an early period of the rising greatness of the United States of America, laboured with great zeal to prove that the pestilential yellow fever was of domestic origin. But the authors of the report just referred to state that "this opinion was nevertheless somewhat modified beforc he ceased exerting a prodigious personal influence upon the mind of man; for he says, 'that it was even produced in Philadelphia from the effluvia from a chest of unwashed clothes which belonged to one of our citizens who had died of it in Barbadoes.'* This influence, says Dr. Monette, has doubtless been the destruction of thousands; and had it not been so great in the medical community of the United States, our northern scaports would not have been so long subject to the pestilential visitations of yellow fever. The southern ports, still acknowledging a vassalage to his authority, and to his arbitrary dictation, through his disciples, to this day immolate hundreds and thousands of victims annually upon the altar of a blind credulity." (*Report*, &c., p. 21.)

27. Can it be possible to adduce a stronger instance than that to which this quotation refers, of the baneful influence of authority upon the minds of medical men? Or is there more satisfactory evidence required, not merely of the importation of the distemper to which it refers, but also of the necessity of enforcing quarantine regulations for the protection of the public? But the instance thus adduced by Dr. Rush is one, not only proving the importation of this pestilence, but also showing the facility of such importation; and, when the nature of the means is considered, the great difficulty, however strict quarantine regulations may be, of preventing it through the medium here indicated. Dr. Lind states that a trunk of clothes was brought from the West Indies into Philadelphia, in 1741, containing the clothing of a young man who died of the yellow fever; and he says that all the persons present when the trunk was opened contracted the disease, which was afterward propagated to other persons in the city. The reporters to the House of Assembly of New-York state that a vessel, which had arrived at New-Haven from Martinico, "had brought home a chest of clothes which belonged to a sailor who died of the yellow fever at Martinico;" that it was opened in the presence of four persons named in the report; that three of these four, in a short time afterward, died of this fever; and that the pestilence was propagated from these to the town of New-Haven. (*See Report*, &c., p. 17.)

28. Now I have adduced these facts, not because they are strong proofs of the importation and infectious nature of the pestilence to which they refer, for, after what I have stated in the preceding articles, no additional facts are required, but because they furnish the strongest evidence of the necessity of quarantine restrictions, and at the same time show the great dif-

[* This statement is altogether erroneous. Dr. Rush, during the latter years of his life, consistently and ably defended the doctrine of the domestic origin of yellow fever. In a letter addressed to Dr. Miller, of New-York, he says: "You will perceive, from the facts and reasonings contained in this letter, that I have relinquished the opinion published in my account of the yellow fever, in the years 1793, 1794, and 1797, respecting its contagious nature. I was misled by Lining and several West India writers. I am aware of the influence which such changes in medical opinions as I have acknowledged have upon a physician's reputation; but small, indeed, should I consider the total sacrifice of mine could it avert the evils which are connected with a belief in the importation of pestilential diseases." In the fourth volume of his "Medical Inquiries" he says, "I beg the forgiveness of the friends of science and humanity, if the publication of that opinion" (alluding to contagion) "has had any influence in increasing the misery and mortality attendant upon that disease. Indeed, such is the pain I feel in recollecting that I ever entertained or propagated it, that it will long, and perhaps always, deprive me of the pleasure I might otherwise have derived from a review of the attempts to fulfil the public duties of my situation." In connexion with Dr. Rush, we may state, that Dr. David Ramsay, in a letter to Dr. Miller, of New-York, in 1800, remarks, "The disputes about the origin of yellow fever, which have agitated the Northern States, have never existed in Charleston. There is but one opinion among the physicians and inhabitants, and that is, that the disease was neither imported nor contagious. This was the unanimous opinion of the Medical Society, who, in pursuance of it, gave their opinion to the government last summer, that the rigid enforcement of the quarantine laws was by no means necessary on account of yellow fever."]

ficulty of so enforcing them as to prevent the introduction of those articles and effects which are most likely to propagate not only this, but also the other pestilences. I have not the least hesitation in maintaining, and I do so from personal observation and knowledge of the fact as respects two out of the three pestilences here considered, that there is more risk of the importation of them from body and bed-clothes, and foul linen of those who have been affected with them, than from the persons of the infected, or from any other source whatever. Every person who has seen much of the communications between distant places by means of trading vessels, who has travelled much, or who has voyaged frequently in those vessels, will admit the difficulty of preventing clothes and linen from being landed, and the frequent neglect of exposing infected articles of this description to due ventilation and cleansing before they are landed. Vessels are even not infrequently, especially in countries where the restrictions are loosely observed, allowed to continue in quarantine until the period is elapsed without the clothes or other personal effects of individuals having been opened up or aired; and not rarely are these articles, more especially dirty linen, sent on shore or smuggled away, without the guards either knowing the occurrence or being able to prevent it.

29. My limits will not permit me to notice the several regulations requisite to the due enforcement of quarantine. These regulations should be based upon the numerous ascertained facts mentioned in the course of the preceding inquiries; and they should be enforced with a full knowledge of the deceptions so frequently practiced or attempted, in order to avoid the detentions requisite to the observance of the law. With highly qualified and duly remunerated health-officers, there can be little reason to dread, either too great severity on the one hand, or too great laxity on the other, even should much be left to their discretion. My object at this place is merely to show the importance of, and necessity for, such restrictions, and to insist upon the strictest attention being given to the bed and body-clothes of all persons who may have been infected, or suspected of being infected, with these pestilences; for, when the numerous ways by which these and other personal articles and effects may pass, from infected places and vessels, to persons at a great distance, even before they are opened up or exposed, are duly considered, it cannot any longer be a matter of surprise that the distempers which they propagate are so often traced with difficulty, or even not traced at all, to their several sources, and through their several channels.*

30. The propriety of enforcing quarantine regulations does not rest upon a few authorities merely. An outcry has been raised, by persons interested in their abolition, that they are supported only by those who are appointed to enfore them. What possible interest can I have in contending for them? What other interest had most of the ablest writers who have advocated them in this and in other civilized countries, than the cause of truth and the interests of humanity? Dr. J. Bayley, in his correspondence with the Mayor of New-York, after adducing numerous proofs of the importation of pestilential yellow fever into that city previously to 1822, concludes as follows: "I cannot suffer this opportunity to pass without expressing my firm conviction that rigid quarantine regulations are essentially necessary to guard the inhabitants of our commercial cities against the introduction of pestilential and infectious diseases." (*Report*, &c., p. 79.) What, also, say other eminent physicians of that city on this important topic? Dr. Townsend, whose experience of the hæmagastric pestilence has been obtained in New-York, in the Havana, in the Bahama Islands, in Charleston in South Carolina, and in the West Indies, thus remarks on the crude speculations and productions of some of those who have recently written on the subject now under consideration. "The true character of the pestilential yellow fever, commencing with the monographs of the earliest writers, as Towne, Hillary, Warren, Rouppe, &c., and the not less masterly descriptions of those who succeeded them, as Chisholm, Blane, Lining (of Charleston, S. C.), Hosack, and a crowd of others, together with the more recent productions of Stroebel of Charleston, and Monette of Washington (Mississippi), &c., have been entirely lost sight of to give place to the more congenial and crude speculations and misrepresentations of empirical adventurers, many of whom, with mercenary motives, designed to flatter the authorities of different governments with the delusive hope that commerce might be disburdened of every such restriction, as a relic of barbarism, have not hesitated to assert, and to disseminate on the subject of yellow fever, a tissue of heresies and errors which every practical physician, and every common citizen acquainted with this disease, as it has prevailed in our seaports and in the West Indies, know to be without the shadow of a foundation."

31. Dr. Vache, of New-York, observes, "that yellow fever has not appeared in that city for nearly a quarter of a century, and not since the present health laws have been rigidly enforced; therefore, let us not forget, in our zeal for innovation and improvement, the good old maxim, 'Let well enough alone.' Admit they are, in a measure, restrictive to commerce and burdensome to the merchant, will any calm observer deny they are alike protective of his life and conducive to his interest? The pecuniary loss of a hundred years by the quarantine establishment cannot equal the ruin and desolation of a single season of the pestilence. Who does not shudder at the memory of closed dwellings, the suspension of business, the shunned city, the quarantine abroad, and the sepulchres of hundreds during the summer of 1822?" (*Report*, &c., p. 97.)

32. Similar opinions to these have been given by Dr. Francis, and other eminent physicians in the United States, and furnish the basis on which the Report is founded, to which I have referred, and which reached me after the chief part of the above article was put to press. These fully confirm the views which I have entertained, as well as furnish most conclusive evidence of the necessity of enforcing quarantine regulations. Dr. Francis, as well as many other eminent physicians, has shown that the hæmagastric pestilence has been imported into

[* See Appendix to this article.]

many places, and into the quarantine districts of the United States, when the thermometer ranged above 75°. Now if the Eclair steamship had arrived in this country when the temperature was at this elevation, or at any period during the summer of 1846, and quarantine regulations had either been neglected or imperfectly enforced, what might have been the consequences? and what may still be the consequences if these regulations should be so far relaxed as to allow of the admission of the foul bed or body-clothes of persons who have died of any of the pestilences just considered, especially during states of temperature and of the air favouring the infection of these pestilences? I fully believe that pestilential cholera was introduced into various places, both in this and in other countries, by foul clothes, and that there is more risk in either of these distempers being imported in this way than by personal communication—than by the infection having been imparted in some place where the distemper prevailed, and remaining latent in the infected person for a number of days, so as to break out only shortly before, or soon after, arrival at the place of his destination. Certainly, all the contingencies of the malady—infection by close communication, by opening up the clothes of infected persons, and such articles of traffic as are calculated to imbibe infectious emanations, or are likely to have been exposed to them; the period which has elapsed from the occasions of such infection and of such exposures, and the several circumstances favouring or counteracting infection, even admitting its presence, as temperature, humidity, or dryness of the air, cleanliness, ventilation, &c., ought severally to be considered when framing regulations for warding off pestilence, and when carrying these regulations into effective operation.

33. How far it may be prudent to relax these laws in respect of merchandise, even still farther than they have been in this country, cannot be stated absolutely and with confidence of perfect safety; for several articles of traffic belong to the same category as apparel and bed and body-clothes, and retain and convey the poison long and far; but caution should be used in such relaxations; and the facts should not be overlooked, that the most obvious and important advantages have already accrued from the recent institution of quarantine laws in Constantinople and other places in the East, and from a more strict enforcement of them in the cities of the United States.

34. To the entire neglect of *government measures of prevention*, and to insufficiently strict quarantine regulations, the extension of the choleric pestilence throughout the countries of the east, and through Europe and America, are entirely to be imputed. The difficulty, however, of completely enforcing these measures, and the liability of evading them in all countries, particularly those which are continental, and have an extended boundary, which are thickly inhabited, particularly on their frontiers, have large and populous frontier towns and seaports, and enjoy a rapid and extensive commerce, either by sea or land, are so great that numerous instances of their infraction must occur, and the chances of the introduction of the pestilence be thereby increased. These circumstances fully account for the importation of the malady into the principal towns and seaports of Russia and Prussia; its appearance in Moldavia, Hungary, Austria, Vienna, Dantzic, Hamburgh, &c.; and the negligence with which quarantine regulations are usually resorted to, fully explains the introduction of this pestilence into Egypt, into this country at various ports, as well as into numerous places in other countries, where stricter precautions might have reasonably been supposed to prove successful.

35. As intimately connected with all regulations of quarantine, the period which elapses from the impression of the morbid cause upon the frame, and the full development of the disease, requires some notice; but, unfortunately, sufficient facts have not been obtained, and those which have been observed are not sufficiently precise to furnish us with exact data on this topic. In respect of plague, eleven or twelve days have been assigned as the extreme period, while other observers have stated fourteen days to be the longest time. Various circumstances, however, serve to show that the full development of the morbid actions constituting these diseases may take place very soon, even a few hours, after exposure to an intense degree of the exciting causes, or when the state of predisposition to become affected has been great; while, on the other hand, several, perhaps many, days often elapse before a marked effect is produced. As to the exact length of time which may, in extreme cases of this kind, thus elapse, I have no means of stating, especially as respects pestilential cholera and hæmagastric fever; but even taking it for granted that a few days merely will often form this period of latent or smouldering action, it becomes obvious that a person may have been exposed to a source of infection, previous to leaving an infected place; that he may travel a long distance, especially in these days of rapid locomotion, and yet not experience the disease until some time after his arrival in a healthy situation, when he may be attacked, and thus he will introduce the pestilence.

36. The unknown duration of the interval which may elapse between the infection of the malady and its full development must render it doubtful what should be the prescribed period of quarantine; but there can be no doubt of the propriety of regulating it according to the length of time during which persons or vessels have been on their passage from an infected place, provided that no source of infection existed in their course. I believe that nothing can be objected to the measures which have been resorted to in this country respecting ships; but it remains a question in what point of view articles of merchandise are to be considered.

37. That the chances of infection by articles of this description are much less than by persons, may, I think, be safely taken for granted; but I still consider those articles which are most likely to have imbibed a portion of the effluvium of the affected, as made clothes, articles of bedding, furs, cotton, woollen, silken, and linen furniture, and rags, to be calculated to transmit the infection. In all cases, therefore, these should be subjected to precautionary measures, and particularly to a full expo-

sure to the open air. It is astonishing how very long woollen and silken bed and body-clothes, especially, will often retain animal effluvia, when closely packed together, or excluded from ventilation. This must be familiar to every medical man who has been in the habit of continuing for a considerable time, or to be frequently in dissecting-rooms; for the animal miasm which his clothes have there imbibed will be sensibly felt months afterward if they have been put in a close place immediately after they were saturated with the foul air.

38. That sanatory measures will succeed in averting a visitation of this pestilence, will much depend upon the nature of the frontier of a country, upon its extent, the number of populous places in its vicinity, and the nature of the intercourse between it and the infected parts. In respect of this last-named source of infection, illicit intercourse, or smuggling, is one of the most probable channels through which the disease will be communicated; and when the population is thick, and the towns large and numerous, the chances of pestilence being introduced in this way are much greater than by regular commercial intercourse, inasmuch as the latter is more or less under the control of sanatory regulations, whereas the former avoids them altogether. Besides, bed and body-clothes, foul linen, and similar infected articles, are more likely to be conveyed clandestinely than by ordinary commercial channels.

39. ii. Of the Arrest of Pestilence when Introduced or Prevailing.—When pestilence is introduced, the measures which should be taken to arrest its progress must necessarily depend upon the extent of its diffusion, upon the number and situation of the places in which it has appeared, and upon the nature of the pestilence itself. As regards the last of these, it may be premised, 1st. That the *hæmagastric pestilence* can be introduced into a country only where the temperature is above 70°; and when the air is close and humid, and the elevation not greatly above the level of the sea; that it is rarely disseminated when the situation is well ventilated, and not thickly inhabited; that frost destroys its infection, and that it attacks the human frame only once. 2d. That the *septic* or *glandular pestilence* may be introduced into a country at all ranges of temperature, from 35° to 75°; that it may remain dormant in favourable circumstances at a temperature either below 35° or above 75°, although these more extreme ranges are more likely to destroy its infectious power; that a close, humid atmosphere, with the other circumstances already noticed (§ 9–23), favour its spread; and that a previous attack generally protects the system from a second, although not so fully as observed in respect of the hæmagastric distemper. 3d. That the *choleric pestilence* may be introduced and prevail in any range of temperature observed in temperate countries, although it is most rapidly and generally diffused in warm, humid, still, and sultry states of the air; in crowded situations, or where intercourse is most frequent, as in camps, barracks, transports, and ships of war; where, also, the other pestilences are more rapidly and universally propagated.

40. It has always been observed that, when either of the pestilences has appeared in a country, the places nearest the frontier or coast, or in most intimate and frequent communication with a previously infected part, are the first attacked. It is obvious that, when once introduced into a populous and commercial town, surrounded either by other towns or by a dense population, the difficulty of preventing its extension is greatly increased beyond what obtains when it appears in a walled city or in an isolated locality. For in all places depending chiefly upon manufactures, and upon commerce with distant or foreign parts, measures sufficiently restrictive to confine the malady there until it shall have subsided or exhausted itself, will be productive of so much distress, by throwing many persons out of employment, and by abridging the means of subsistence, and so injure the health of the community, and predispose to the extension of the distemper, as to induce all classes to combine to evade them, until the pestilence will spread, notwithstanding these restrictions. The failure, however, of such measures is not to be viewed, as it has been by the anti-infectionists, as a proof of the justice of their cause, but of the impossibility of preventing communications, indirect or direct, between the sick and the healthy, in these circumstances.

41. *A. When pestilence first appears in a populous city or town thus circumstanced*, the chief measures of prevention ought to be directed to the infected habitations, as will be pointed out hereafter, and to the infected persons and things which introduced the distemper. Those attacked should be immediately removed, in conveyances constructed for the purpose, to an isolated hospital, devoted to them only; and suspected persons, or those in close communication with the infected, but not yet attacked, ought to be removed to another hospital or place of observation near to, but not connected with the former, to which all should be conveyed as soon as they are seized. All intercourse between the inmates of infected houses and of those adjoining should be prevented, or placed under rigorous restrictions; and thus the pestilence may be strangled at its birth. In all outbreaks of pestilence, the attendants, and those employed in removing the infected, ought to be selected from those who have been attacked on some former occasion; and they should be provided with linen, canvas, or other suitable dresses; and the medical attendants ought not to leave persons infected by either of these pestilences and proceed abroad, or to visit other persons, without changing the clothes, in which patients in pestilence were seen, for other garments.

42. If pestilence spread notwithstanding these restrictions and precautions, more especially in large towns, and a thickly inhabited surrounding country, more advantage will accrue from the individual means of prevention hereafter to be noticed than from measures which aim at that which cannot be enforced or accomplished, namely, the maintaining a strict non-intercourse with the vicinity. Where, however, this object may be attained with reasonable hopes of success, it should not be neglected. But in a place where, besides a frequent intercourse with other parts by shipping, an hourly communication by means of stage-coaches, wagons, canals, and railroads is

kept up with other towns in all directions, I cannot see that quarantine or sanatory *cordons* can be strictly maintained, or regulations be enforced in such a manner as to prevent the extension of the malady. How can various effects and articles, even those most likely to transmit the pestilence, he sequestered for the purpose of purification, and yet avoid all chances of conveying it? And how, especially, are the hundreds, or even thousands of persons whom their avocations daily call to adjoining parts, many of whom may have been exposed to infection previous to their departure, to be placed in quarantine, or in observation, for a sufficient time to avoid all chances of their conveying the disease to the places of their destination?

43. I conclude, therefore, that where a strict quarantine, or sanatory measures calculated to confine the pestilence to the place of its introduction, cannot be maintained, the mischief resulting from the attempt will be greater than the benefits which will arise to the community. But that, where they may be enforced, owing to the nature of the locality, the employments of the population, the distance from other towns or populous places, and the thinly inhabited state of the surrounding country, they should be adopted, notwithstanding the temporary losses, or even distresses, of the place thus sequestered, for the good of the few should give place to the safety of the many.

44. *B. When pestilence is introduced among troops in armies or in garrisons*, the very best results will be generally obtained if decided measures be early resorted to, as shown by those devised by Sir W. Pym at Gibraltar. Notwithstanding the existence of medical boards in this country and in each of the presidencies in the East Indies, there does not appear to exist any code of regulations by which either the young and inexperienced medical officer, or the more responsible and experienced army physician may be guided wholly or in part, or which he may mould to circumstances. In 1831 Sir David Barry, whose talents were great, and sphere of observation extensive, published several suggestions on this subject, with reference especially to the hæmagastric pestilence of Gibraltar, but applicable to all outbreaks of pestilence in armies or garrisons. How far they have been adopted in garrisons or among troops liable to be infected by either pestilence, I am unable to state; but there was formerly, and I believe that there still is, in all departments of the army, more especially in the East Indies, a most remarkable neglect of sanatory or precautionary measures. Those which I have now to offer are in several respects the same as were recommended by Sir D. Barry.

45. *a.* When pestilence shall have been proved to exist within a fortress, garrison, or encampment, let the sick and the suspected be immediately removed without the walls, or placed in tents in dry, airy, and open places, or in hospitals, or places fitted up as hospitals, when these are more favourably situated or circumstanced, and there kept effectually separated from the healthy, unsuspected, susceptible part of the inhabitants.

46. *b.* Let the infected houses and goods be kept in strict quarantine, and purified by water, air, fumigations, and every other means that may be thought advisable; great care being taken that these expurgatory measures be executed by non-susceptible persons, or those who have been attacked by the pestilence on former occasions of its prevalence.

47. Let no time nor labour be thrown away, at this most important crisis, on cleansing drains or privies. Experience has already proved, most fully, both in Cadiz, in the great epidemic of 1800, and in Gibraltar in 1828, the perfect inutility, nay, the absolute mischievous tendency of this measure, when adopted after the pestilence has commenced, with the view of arresting its propagation.

48. *c.* Should the infection appear to spread within the territory or fortress, notwithstanding the removal of the first sick, all theories must be abandoned, and one established fact must alone guide all our measures, viz., *that the disease will stop as soon as the susceptible are separated from contaminated places, persons, and things.*

49. *d.* Since, however, it would be obviously impracticable to remove all the susceptible from a fortified town, or garrison, at once, when an epidemic breaks out after a long interval of public health, and when, besides a large portion of the civil population, the whole garrison may belong to this class, as was the case in Gibraltar in 1828, all the moveable sources of infection and fomites should be sent beyond the walls, and as many as possible of those capable of being affected by such sources as cannot be removed. The civil hospital of a fortified town should also he transferred, with its whole establishment, to the open ground or any situation as above (*a*) directed, to serve as a nucleus of a civil lazaretto, on the very first breaking out of pestilence. The regimental hospital, also, should be sent out, as the corps to which they belong happen to be attacked. No family or person, after having been once contaminated, should be allowed to remain an hour in a fortress or fortified town, particularly at the commencement of an epidemic, but should be removed to the places above indicated, where they should he strictly secluded or placed in rigorous quarantine.

50. *e.* Temporary emigration should be encouraged among the healthy, uncontaminated, and unsuspected civilians; and the whole susceptible population, civil and military, should be scattered over the open ground and adjoining country, as widely as circumstances will admit, due care being taken that the places or ground occupied by the sick, suspected, and the hospitals should not he too nearly approached (*a*) Whenever a regiment becomes infected, it should be immediately encamped outside the town, city, or fortress, if it can be spared; hut if it cannot, it should be removed to as open and as well-ventilated a place as can be obtained, and the infected instantly carried to the hospital.

51. *f.* The sanatory division of the healthy into the susceptible, and the non-susceptible or those previously attacked, naturally dictates the classification of the sick into the decidedly infected, the suspected, and the unsuspected. There should, therefore, be three distinct hospital establishments, viz.: 1. The foul lazaretto for pronounced cases. 2. The lazaretto of observation, for those cases which may, or may

not, turn out to be infected. 3. The free or clean hospital, for accidents or non-susceptible sick. All the attendants of the first and second establishments, medical, clerical, and others, should be kept, if possible, in quarantine.

52. *g.* The bed, bedding, and every thing personal to the sick soldier, sent to either of the two first hospitals, should follow the fortunes of their owner. If the sick man should happen to die, his effects will thus remain where they can do no further mischief, viz., in the foul hospital; should he survive, they accompany him to the convalescent depôt, and thence, after having undergone the most careful ablutions, fumigations, &c., to the suspected quarter within the fortress, on his return to duty.

53. Hospital bedding, properly so called, should be used, as in time of public health, in the clean hospital only. This, of course, implies that the bed and bedding of the unsuspected sick need not be removed from the tents or quarters of the healthy.

54. *h.* There should be three descriptions of camps and quarters, corresponding to the hospital establishments; the foul, the suspected, and the clean, or free. These should be kept distinct during the epidemic.

55. Convalescents from the foul and suspected hospitals should be returned to the fortress, after their recovery, placed in suspected quarters, and appointed to the lightest duties at first, distinct from the uninfected, until the return of public health.

56. *i.* The guards, and all other duties within the town and in the sheltered situations, should be reduced to the minimum consistent with the safety of the fortress; and, as soon as the original and convalescent non-susceptible soldiers are sufficiently numerous to perform these duties, the susceptible should no longer be permitted to participate in them.

57. *k.* The epidemic sick should, as far as practicable, be treated in detached tents, huts, or sheds, so placed and constructed as to admit of the most perfect ventilation. It will not be enough for the protection of the susceptible, nor for the benefit of the sick, that the latter be sent outside the gates. They must be so placed as not to be sheltered by the outworks from currents of cool air.

58. *l.* Should it so happen that troops in garrison, or otherwise in service, cannot furnish a sufficient number of non-susceptible (formerly attacked) orderlies for attending upon the infected, civil attendants of that class should be employed from the commencement.

59. *m.* In the pitching of tents, and particularly in the erection of boarded sheds, as temporary hospitals, places of seclusion, observation, &c., care ought to be taken that they be not huddled too closely together, and that they be so placed in regard to each other as to allow a free passage for currents of air; for nothing tends more effectually to prevent and to destroy the propagation of infection than open space and perfect ventilation.

60. *n.* The first and most important steps towards the saving of human life, on the breaking out of pestilence, being the early detection of it, and the firm, unhesitating announcement of its existence to the proper authorities, the chief medical officers, or those best acquainted with its characters, should carefully observe and report upon all cases of sudden attacks and of malignant features.

61. *o.* When corps, detachments, re-enforcements, or armies are marching or changing quarters, care ought to be taken by commanding officers to cause all quarters, barracks, and encampments to be inspected by trustworthy and experienced medical officers, in order to ascertain their cleanliness, salubrity, &c.; and, as far as possible, the state of health of the previous occupants, and the existence or non-existence among them of any malignant, infectious, or febrile disease. The three pestilences above considered have severally been often propagated in this way to both troops and civilians; those departing carrying with them and imparting on their route the infection to others; while healthy troops have rapidly been infected upon arriving in the contaminated quarters which had been relinquished to them. This shows the necessity of using the most efficacious disinfecting means to all quarters and barracks that are in the least suspected, before healthy troops approach them.

62. *p.* When troops or detachments are upon march, care should be taken not to allow any of the men, or even of the officers, to enter towns or villages before the state of health of such town or village is inquired after by the principal and most experienced medical officer; and this inquiry should be made at the chief authorities and medical practitioners of the place. Want of attention to this, and to the immediately preceding precaution, has been the cause of the infection of healthy corps, on numerous occasions in the East and West Indies, with the pestilential cholera and yellow fever.

63. *C. When pestilence is introduced into ships, especially transports, ships of war, and emigrant vessels*, it will be most difficult, if not impossible, to prevent its extension to all susceptible persons in such vessel. Hence the necessity of the utmost precaution in preventing communication with ports in which even the suspicion of the existence of pestilence may be entertained. Trading vessels are, however, often bound to ports where one or other of the pestilences above considered is more or less prevalent, or where it sometimes breaks out during the continuance of the vessel in the port; and in such circumstances the infection of one or more of the crew generally occurs; for sailors usually frequent those places in which a pestilential malady generally makes its first appearance, or most commonly lurks, awaiting susceptible subjects, especially in regard of plague and hæmagastric pestilence, for its outbreak. Besides the infection introduced in the persons of sailors infected on shore, infection may be introduced in clothes, especially such as may have been previously worn, purchased by them and brought on board. Vessels, also, may be infected by incautious communication with other vessels, especially in the Mediterranean, and on the coasts of Africa and America, and more particularly with slave-ships.

64. When a pestilential malady thus appears in a vessel in port, the circumstance should be dealt with as follows: If the vessel have been infected in the port, the distemper existing at the time in the port or its vicinity, the person or persons attacked ought to be instantly land-

ed and taken, with all the precautions against the diffusion of the infection, to the hospital or place provided for pestilential cases, unsusceptible or formerly attacked individuals being employed for the removal, if they can be obtained. The vessel should be removed to some distance from others, and ventilation and purification resorted to. If the vessel have conveyed the disease from an infected place to a healthy port, especially during seasons and temperature which favour the propagation of the distemper, communications of all kinds ought to be strictly prevented with the infected vessel. She should be instantly placed in quarantine, in a suitable place, and health guards sent on board. The persons already infected ought to be sent to the quarantine hospital, and the susceptible non-infected removed to an observation hospital, ship, or place, and their clothes be carefully ventilated, cleansed, or fumigated. The vessel and articles in her capable of imbibing infectious emanations should be purified by non-susceptible persons.

65. The greatest risk of the introduction of pestilence, and of the diffusion of it among the crew, arises from the concealment, on the part of the captain of a trading vessel, of the illness or death of any of his passengers and crew, and from the preservation of the bedding and clothes of the infected, which are often concealed and smuggled on shore, or even openly preserved and sent home to the relatives of the deceased. It has been frequently found, in the quarantine ground at New-York, that the hæmagastric pestilence has reappeared in vessels after purification had been, as was supposed, sufficiently resorted to. This failure of the usual means of disinfection, in respect of these vessels, may have arisen from some articles of clothing or bedding having escaped notice or sufficient purification, or from the return of such articles to the vessel without due ventilation and cleansing; or from the circumstance of the infection having remained longer latent in the system before it developed its effects than is generally believed to be possible.

66. When the hæmagastric pestilence breaks out in a vessel within the tropics, it has usually been recommended, and practiced, to proceed forthwith to a colder climate, or to latitudes in which the range of temperature is below 60°; all the usual means of ventilation and disinfection being at the same time employed. In some circumstances this measure may be judicious. But it should not be depended upon when the vessel, especially a ship of war or transport, is so circumstanced as to admit of the instant removal of the infected into a quarantine or other appropriate hospital, and of the susceptible non-infected into an observation hospital or ship, and of the immediate disinfection of the ship. The great errors, in many instances of the outbreak of this pestilence in war-ships within the tropics, have been, 1st. The non-recognition of the distemper by the medical officers; 2d. The too frequent denial of its infectious character, and the proceeding upon that supposition; and, 3d. The neglect of measures based upon its infectious character, and especially of the immediate separation of the infected, and the removal of them to the pestilential hospital, even when such removal could have been carried into effect.

67. The sending of a vessel to sea ought never to be enforced where the means of immediate separation of the sick and suspected, and of purification, can be carried out in the place or port where the vessel lies; for, by doing so, the infection of the whole susceptible persons in the crew, or among the passengers, is thereby ensured before she can possibly reach a temperature so low as to put a stop to its extension. In cases of ships of war or transports, the captain should be advised to proceed to the nearest port where these measures can be enforced with all the precautions of quarantine, and without endangering the inhabitants of the port; and a recourse to a colder climate should not be entertained unless it may be certainly reached in a much shorter time. But the distemper may appear in vessels in such places and circumstances as preclude the possibility of reaching either a suitable port or a colder climate, within a period likely to save the crew, or at least a large proportion of them. In this dilemma, and even while the attempt to reach either of these destinations is being made, the resources of the medical officer, as well as of the captain, become of the greatest importance, and, if wisely directed, are always most advantageous.

68. In the circumstances now adverted to, every means of ventilation consistent with the safety of the ship should be enforced. The hatches and gun-ports ought to be constantly open, and wind sails carried down to the lower decks and hold. The infected should be removed instantly upon being attacked from among the crew to a well-ventilated place upon the upper or gun-deck, and be excluded as much as possible from all persons but the unsusceptible or those who have been formerly attacked, and these latter should be made attendants on the sick. The sick-berth should be separated by a bulkhead or partition, and be in the best ventilated part of the ship. A number of the crew of a ship in which I was a passenger many years ago, had been exposed to the infection of pestilential yellow fever; and as they were attacked I advised them to remain on deck under an awning, a free perflation of air existing around them. The accumulation of infectious emanations was thus prevented, and the distemper extended no farther than to one only of the crew who was not exposed to infection in the first instance. The seclusion of the infected and ventilation should be rendered as perfect as possible; and all the evacuations ought to be instantly removed in covered vessels and immersed in the sea, without uncovering them until actually immersed. Various disinfecting agents, especially the solutions of the chlorides, the vapour of creasote, &c., may be employed, but they should never interfere with a recourse to every possible means of ventilation, to which they should always be subordinate in importance, as they are in efficacy.

69. II. Protection of Individuals, Families, or Classes from a prevailing Pestilence.—When pestilence exists in a city or place, or when measures have not prevented the introduction of it, much may be accomplished by cautiously devised means either of avoiding it, or of enabling the frame to resist it. The most certain way of escape is,

70. i. Departure from the Sphere of Infection, or strict Seclusion or Quarantine.—Departure from the infected city or place is protective to all such as have not been exposed to the emanations from the sick, and from fomites, previously to their departure. In the Levant, European consuls and merchants generally observe strict seclusion during the prevalence of plague, but the seclusion is enforced with great difficulty in respect both of persons and effects, more especially body-clothes, &c. Moreover, when seclusion is attempted in a house or mansion forming part of a street, or within the walls or limits of a town, the atmosphere around the place of seclusion may be so contaminated by the numbers of sick and dead as to become more or less infectious to the inmates of the secluded residence; and the winds or currents of air may convey the infection into the very apartments of such residence. This circumstance fully explains the failure of seclusion in affording protection in the comparatively few instances in which seclusion has failed.

71. *A. In order, therefore, that protection may be with great certainty procured,* departure from an infected town or place should be immediate upon the ascertainment of the existence of pestilence, and before the pestilence has extended itself to many of the inhabitants; for, if it have spread far, or if cases of it have occurred in most of the quarters of a city, it is impossible to determine who is, or who is not, already infected, although not yet attacked, and the distemper may be conveyed to healthy localities in the persons or effects of those who may then depart. Indeed, this contingency has been often observed as regards each of the three pestilences in question. The same remark equally applies to seclusion or quarantine within or near an infected city or place; for, if the seclusion be too long delayed, some one of the persons about to be secluded may have been exposed to the infectious effluvium, and be attacked several days after this precaution has been adopted, and thus introduce the distemper among the secluded party. In this case, the farther extension of the malady may be prevented by the immediate removal of the person attacked, with his personal effects, from the place of quarantine; but the removal should be effected, if possible, by non-susceptible persons.

72. Those who may be unable to depart from an infected place, or to seclude themselves, should carefully avoid a too near approach to any person either in a street or in a house, and more especially to those who are strangers. Above all, they ought to avoid the breath or the expired air from another person; and they should not enter the houses or apartments of any one unless there is the fullest evidence of immunity from infection. But even when no risk may be anticipated, persons or articles may be in these houses at the time which may endanger those who approach them. If any danger exist as regards the reception-rooms of a house, the danger is greater in respect of the sleeping apartments. Great caution should, also, be exercised as respects articles of clothing, beds, and bed-clothes. During seasons of pestilence, the linen of a family ought not to be sent out of the house; it should be cleaned at home; and care ought to be taken that this precaution extends to the servants more especially; and no beds, bedding, or clothes, more especially such as may have been previously used, ought to be admitted. Strangers, and particularly those with effects, ought to be excluded as much as possible, unless they come direct from healthy and uninfected places.

73. *B. Restrictions should be imposed on those departing from an infected locality,* in order that they may not convey the pestilence to the places of their destination, and that they may be received in these places in such a way as may least endanger the safety of the inhabitants.—*a.* Persons who appear to be already attacked, or those who have members of their families attacked, or who have recently lost any of their family, either should not depart for a healthy locality, unless the departure be to a country residence or house, secluded from other houses, or should be subjected to strict quarantine before being admitted into towns, cities, or ports.

74. *b.* All persons leaving infected places ought to obtain from the Medical Board, or Board of Health, which should exist in all cities and large towns, certificates of the probable degree of immunity from infection existing in their individual cases, to be produced to the authorities of the places to which they are about to proceed. The information supplied by persons requiring these certificates may be verified by the messengers of the board.

75. *c.* Persons already infected, and suspected cases, instead of being allowed to depart for healthy towns, should be removed to quarantine, infected, or observation hospitals, according to the circumstances of each case, and not be permitted to endanger the inhabitants of an uninfected place until due precautions have been strictly enforced.

76. *d.* It is obvious that, if certain restrictions are requisite on persons departing from an infected place, they are still more necessary for those who arrive at an uninfected city or port; and more especially for those who come from an infected part. On these latter, a due period of observation and quarantine should be imposed, when the circumstances of the locality or town are such as admit of the restriction being duly enforced. The chief difficulty is the determination of the period of observation or quarantine in each of the pestilences in question. When persons have already passed some time from leaving an infected place before arriving at their destinations, a proportionate abridgment of the period of quarantine may be allowed, especially if no sources of infection existed at any place in their routes. In the case of a person arriving directly from an infected place not far distant, there is every reason to believe that a quarantine of fourteen days would afford sufficient protection, in respect of any of the pestilences now considered. But the clothes and personal effects of this person should be immediately opened up and ventilated.

77. *e.* In all cases, where the clothes, linen, and bedding are infected, or even suspected, disinfecting agents should be applied to them. Of all disinfectants, high ranges of temperature are the most efficacious; and the best method of employing a high temperature, with the view of decomposing the morbid effluvium retained by the bedding or clothes of persons who have

laboured under pestilential and infectious maladies, is that invented by Mr. Davison and Mr. Symington, who recommend the transmission of heated air through a chamber in which these articles are suspended, the temperature of the air being raised to grades varying from 200° to 250° of Fahrenheit. The great advantage of this method is its easy applicability to all kinds, and to any number, of objects and articles,* without injury to their textures or fabrics.

78. ii. Protection by such Means as may enable the Constitution to resist Infection. —*A.* There are four facts which should be kept in recollection, as being intimately connected with the adoption of preservative measures against pestilence: 1st. That a specific principle or effluvium, probably of a parasitic or organic nature (Pestilence, Septic, § 137), proceeding from the diseased, is necessary to the communication of the malady. 2d. That this specific effluvium is inhaled with the air into the lungs when a person sick of either pestilence is too nearly approached; and that the infecting effluvium invades the susceptible frame chiefly through the respiratory passages and organs. 3d. That a predisposition to become affected by this effluvium is requisite to infection by it, or a susceptibility of infection. In what this susceptibility consists can hardly be determined with precision in many cases, and as respects each of the kinds of pestilence, although there is sufficient reason to believe that the causes of predisposition described above, with reference to each of these distempers, are more especially concerned in producing it; and, 4th. As regards two of these maladies, at least, a previous attack destroys this susceptibility. Upon these facts all prophylactic measures should chiefly be based.

* Messrs. Davison and Symington, civil engineers, have employed heated air, in various modes, both in currents and otherwise, and in various grades from 60° to 600°, and for numerous purposes—for the drying and seasoning of timber, for the prevention of dry-rot, for the drying and preserving of animal and vegetable substances, for cleansing casks, and for preventing mouldiness, and the formation of fungi, and other parasitic productions; for disinfecting foul clothing, feather and wool beds, mattresses, &c.; and have obtained patents for the application of heated air to all these, and various other purposes. Their experiments prove that currents of heated air, of 250° and upward, may be passed through linen and cotton articles, for the purpose of disinfection, without injury to their textures, and that woollen and other animal productions, as feathers, feather beds, wool beds, hair mattresses, cloths, flannels, &c., will not be injured by a temperature of 240°. It is obvious that the application of this method to the purification or disinfection of all kinds of bedding, and bed and body-clothes, used in hospitals, ships, prisons, &c., will be of the utmost advantage. Even to private families it will often prove most beneficial, especially in arresting the progress of infectious diseases, to transmit the contaminated beds, bed-clothes, &c., to a place where this mode of purification and disinfection is employed. On the occasion of smallpox, scarlet fever, typhus, or measles having infected one or more members of a family, the infection being, possibly, limited to one chamber or floor of the house, and due precaution being taken so to limit it, the properly-constructed and carefully-closed cart of the establishment might remove the contaminated articles to the place of disinfection, and return them in a very short time, thereby preventing the extension of the malady to the rest of the family, or to other persons by that medium which is most likely to transmit the infection. In these maladies, and still more remarkably in pestilential distempers, this method of disinfection deserves a general adoption, in respect both of its great efficiency and of its universal applicability. When feather beds, or woollen and hair mattresses, have become foul or impure, as they must necessarily become when in long use, especially in hospitals, prisons, ships, &c., this method of purification is particularly necessary. The beds used in lying-in-hospitals ought frequently to be subjected to this process, in order to prevent puerperal fevers and diseases.

79. As respects the first and second of these, the measures above recommended, in order to prevent exposure to infection, are the most efficient, the great object being to avoid intercourse with such persons as are most likely to have been among the infected, and a near approach to contaminated articles. The predisposing and concurring causes of the distemper, as far as they are known, ought to be avoided. There is much reason to believe that whatever tends, directly or indirectly, to exhaust the vital energy, especially excesses of every kind; low and unwholesome diet; exposure to cold chills, wet, night-dew, &c.; the use of cold fluids, of cold, flatulent, and unripe fruits, will favour the invasion of pestilential infection. On the other hand, whatever supports the energy and preserves, in their due regularity, the several functions of the frame, will render the body less susceptible of infection.

80. If at any time exposure to the night air, or to cold and moisture, is inevitable, the system should be fortified against them, but not, unless when better means are not within reach, by wines or spirits; for these should be used in very moderate quantity, otherwise they will leave the system, as soon as their stimulating effects have passed off, more predisposed than before to the invasion of the infectious effluvium. Medicinal tonics, however, and those more especially which determine the circulation to the surface of the body, at the same time that they improve the tone of the digestive organs, and promote the regular functions of the bowels and biliary system, may be resorted to on such occasions. For this purpose, the infusions or decoctions of bark, of cascarilla, of columba, &c., with the spirits of Minderer, or any warm stomachic medicine; or the powdered bark, or the sulphate of quinine, or the balsams, may be taken either alone or with camphor, or with the aloes and myrrh pill, and any one of the spicy aromatics.

81. *B. Olive oil* has been much employed, both in Spanish America and in the Levant, not merely for the cure, but as a prophylactic, of pestilential distempers: in the former countries, with lime-juice, in the hæmagastric pestilence; in the latter, both internally and externally, for the plague. It is usually given in full and frequent doses in both distempers; and, from the information I have derived from various quarters, it appears to be deserving of a much more extensive trial in these pestilences than it has hitherto received from European physicians. As a prophylactic, it has usually been employed externally with slight friction, after coming out of the warm bath. It is much employed in both hemispheres by the native practitioners of medicine.

82. *C. The diet* should be regular, moderate, nutritious, and easy of digestion. While every approach to low living should be shunned, its opposite ought never to be indulged in. The stomach should have no more to do than what it can perfectly accomplish, without fatigue to itself, but to the promotion of its own energies. It must never be roused to a state of injurious excitement by means of palatable excitants, nor weakened by over-distention, or too copious draughts of cold, relaxing diluents.

83. Care should be taken never to be exposed to the morning or night air with an empty

stomach. A cup of coffee previous to such exposures will be serviceable. The state of the bowels should be always attended to, and their functions regulated and carefully assisted; but in no case should this be attempted by cold, debilitating medicines, such as salts. The warm stomachic laxatives, or those combined with tonics, may be adopted with advantage as occasion may require.*

84. Particular attention ought to be paid to personal and domestic cleanliness. The surface of the body should be kept in its natural and perspirable state. The constant use of flannel nearest the skin will be serviceable for this purpose. Excessive perspirations ought to be avoided.

85. During the existence of either of the pestilential diseases in our vicinity, or family, these precautions are still more imperatively required. A free ventilation of every apartment ought to be constantly observed; in conjunction with fumigations, by means of aromatic substances kept slowly burning, or by the vapour of the chloride of soda or of lime. If a quantity of a very weak solution of the chloride of lime be put in a vessel, and some muriatic acid poured on it, and placed in the hall, or the very lowest parts in a house, the disengaged gas will soon find its way in sufficient quantity to the higher apartments.† The attendants on the sick should particularly observe the measures now prescribed, and ought never to bestow their attentions on the affected so near their persons as to inhale the effluvium emanating from them, without at least fortifying the vital energies in the way pointed out; and they should carefully avoid entering upon those duties with an empty stomach, or when fatigued.

86. Besides burning warm aromatic substances, and odoriferous gum-resins, in the apartments, and in those adjoining them, in which affected persons are or have been confined, a saturated solution of camphor in aromatic vinegar, or in the pyroligneous acid, should be occasionally sprinkled on the floors, furniture, and bed-clothes. These means, with a thorough ventilation, and a due attention to cleanliness, will not only counteract the influence of the effluvium proceeding from the affected, and ward off its action even on the predisposed, but will also prevent the clothes, bedding, or furniture of the apartments of the sick from becoming imbued with it so as to communicate the malady. They are within the reach nearly of all; and, in the event of the extension of pestilence to any considerable town or city, if care were taken to see them put in practice, under the direction of medical councils of health, one of which should be formed in each district, or quarter, much good would result from them. Keeping in recollection the principle with which I set out, namely, that the exciting cause of the disease undoubtedly makes its first impression on the lungs, the advantages of those measures, from the circumstances of their being applied especially to this organ, must be obvious.

87. *D. The state of the mind* also requires judicious regulation. It ought never to be excited much above, nor lowered beneath its usual tenor. The imagination must not be allowed for a moment to dwell upon the painful considerations which pestilence is calculated to bring before the mind; and least of all ought the dread of it to be encouraged. There is a moral courage sometimes possessed by individuals who are the weakest, perhaps, as respects physical powers, enabling them to resist more efficiently the causes of infectious and epidemic diseases, than the bodily powers of the strongest, who are not endowed with this mental energy. Those who dread not attacks of diseases, and who yet exercise sufficient prudence in avoiding unnecessary exposure to their predisposing and exciting causes, may justly be considered as subject to comparatively little risk from them. This, I am persuaded, is particularly the case as respects the pestilential cholera, and I wish to impress it upon the minds of those whom the observation concerns. On all occasions a fool-hardy contempt or neglect of ailments, especially those affecting the stomach and bowels, ought to be guarded against, and the best medical advice be immediately procured upon the first manifestation of disorder.

[APPENDIX.]

Professor Charles Caldwell, of Louisville, Ky., has written a very able treatise on the

* Any of the following recipes may be employed for the purposes here recommended:

No. 319. ℞ Decocti cinchonæ, ℥ivss.; liq. ammon. acetat., ℥iss.; spirit. amnion. arom., ʒij.; tinct. capsici annui, ℥xx.; spirit. pimentæ, ʒij. Misce. Fiat mist. cujus capiat coch. j. vel ij. vel iij. pro re nata.

No. 320. ℞ Infusi Cascarillæ, ℥vjss.; potassæ subcarbon., ʒj.; tinct. aurantii comp., ʒiij.; spirit. lavandul. comp., ʒjss. M. Fint mist. cujus capiat cochlear., ij. vel iij. larga, mane nocteque.

No. 321. ℞ Quininæ sulphatis, ℈j.; massæ pilulæ aloes et myrrhæ, ʒss.; Extr. Anthemidis, ʒj. M. Fiant pilulæ xx. quarum sumatur una mane nocteque.

No. 322. ℞ Camphoræ rasæ, ℈j.; extr. gentianæ; pilul. aloës cum myrrha, ää, ʒss.; pulv. capsici, gr. xv., sirupi simp., q. s. M. Fiant pilulæ xxiv. quarum capiat binas mane nocteque.

No. 323. ℞ Camphoræ rasæ, ℈j.; pilulæ galbani comp., ʒss.; quininæ sulphatis, gr. xii.; pulv. capsici annui, gr. xx.; balsami Peruviensis, ℈j. Fiant pilulæ xxx. secundum artem, quarum capiat binas primo mane ac nocte.

Shortly before the sailing of the Niger Expedition, sent out by government, a physician, one of the naturalists to the expedition, called upon me, he having heard that I had been in or near that part of Africa to which he was about to proceed. During our interview, I advised him to take three grains each of camphor, sulphate of quinine, and capsicum, night and morning, during the period of his exposure to the malaria proceeding from the low grounds near the banks of the river, and to increase the dose to five grains of each when the exposure was greater than usual, or the malaria more concentrated. This gentleman called upon me, upon the return of the expedition, to thank me for my advice, which he had followed, and he informed me that he had not experienced a single day's illness.

† Dilute one part of the concentrated solution of *the chloride of lime* with fifteen parts of cold water, and stir the mixture for a few minutes.

Place an open earthen vessel, containing a quart of the diluted solution, in the current of air entering the room or place to be disinfected, and pour into it a wineglassful of the hydrochloric acid: perfect purification will very speedily take place. In about an hour fresh air should be admitted as freely as possible. If clothes supposed to be infected are suspended in the room during this process, they will be readily purified.

To disinfect rooms in which sick persons are confined (who would be incommoded by the above rapid mode of purification), wet a linen cloth with the diluted solution, and suspend it in the place to be disinfected: it will require renewal two or three times a day. Night-chairs, or any vessels in which putrid animal or vegetable matter has been kept, will be immediately disinfected by rinsing them with the diluted solution; a small quantity of which may afterward be allowed to remain in them while in use.

To disinfect drains, sewers, and water-closets, a quantity of clean water should first be thrown down them, and afterward one or two gallons of the above diluted solution.

contagiousness of plague, yellow fever, and cholera, which was crowned with the Boylston medical prize of Harvard University for 1834. To this essay the reader is referred for a vast amount of information in opposition to the contagiousness of these diseases. Dr. C. is, accordingly, opposed to all quarantines, regarding them as founded in error and superstition, and a relic of barbarous times. "Nothing," he remarks, "in the history of despotism can surpass them. Though professedly intended for the benefit of man, they are strangers, within their sphere, to human right and human sympathy. To say they make sport and food of the sufferings and misfortunes of man, would scarcely be extravagant. They may, and often do, prohibit at pleasure, during indefinite periods, and under heavy penalties, all forms of business, and, as far as they can, of social intercourse, whether public or private; invade personal freedom, by confining those who become obnoxious to them to their own dwellings, or in places worse than common prisons; assume the right to destroy property, to the ruin of its owners, on mere supposititious grounds, and have been frequently carried to the taking away of life. The modifications that have been made in them have been far from keeping pace with the progress of that branch of science by which they should be regulated. They manifest, therefore, no practical wisdom, and have done no appreciable good. I speak of the evil they constitute, as it prevails throughout the world. In the United States, and a few other places, it is somewhat mitigated, but is still sufficiently annoying in its operations and grievous in its effects. Quarantine establishments, then, are still the product of the fourteenth, with but little affinity to any of the institutions of the nineteenth century. That consideration alone renders them objects of well-founded suspicion, the date of their origin being, in so high a degree, unfriendly to truth and usefulness in all that depends on physical science."

With respect to the contagiousness of plague, we are not so particularly interested, perhaps; but it is nevertheless well to reflect, that the British government has long maintained quarantines in London, Liverpool, Bristol, Portsmouth, Falmouth, Milford, and all other ports between which and the whole country of the Levant, and, indeed, every Oriental place of business visited by plague, an extensive intercourse by commerce has been constantly maintained; and yet, although suspected cargoes that have entered them have been opened, examined, and familiarly handled in innumerable cases, for nearly two hundred years, no opener, inspector, or cleanser of reputedly infected goods in them has ever sickened of plague; nor has a single patient affected with that disease been received into their lazarettoes. The same remark will apply to vessels from the Levant arriving in this country. With respect to the yellow fever, there can be no doubt, as stated by Dr. Caldwell, that when the disease first broke out in Philadelphia, in 1793, the views of the physicians of our country respecting it were directly the reverse of what they are now. The belief in its contagiousness was universal; hence the wide-spread panic produced, and the numerous barriers that were erected to prevent it from overrunning the land. From that time to this, quarantines, more or less rigid, have existed in nearly all our Atlantic ports, but with a gradual relaxation, until, at the present time, when some of them, as New-Orleans and Mobile, have no quarantine whatever. There can be no doubt whatever that the port regulations of this city, for example, have been needlessly oppressive and vexatious, previous to their recent modification (1846), and that they are still unnecessarily stringent. We have seen, that although vessels have been allowed to come to, and unload at the wharves of Brooklyn for the last thirty years, where the population is as compact as in New-York, there has not been a single case of yellow fever communicated to the inhabitants, nor has there been the slightest fear of such a result. Quarantine regulations should form a part of a general code of sanatory discipline, and the quarantine board should be but a branch of a general board of health.

We are not aware that there is a particle of evidence to show that the yellow has ever been imported by the *sound* cargoes of vessels coming from infected ports; and, even with respect to the bed or body clothes of passengers, the risk of its introduction in this way is very small indeed; though it will always be prudent to avoid this risk, especially as it can be done with so little trouble and expense. More attention ought to be paid to the condition of ships' holds than is usually the case. It is universally agreed that a foul hold is a not unfrequent cause of bad fever on board—a fever that may eventually acquire an infectious character. If the duration of quarantine was made to depend on the state of the vessel, rather than the port from which it came, or the time of year it may arrive, much expense and delay might be saved, and the public health be equally protected.

The great object of sanatory establishments should be to keep the atmosphere in a pure condition, for even infectious diseases cannot spread under such circumstances; foul ships and damaged cargoes should, therefore, be excluded until rendered innocent by purification, because they tend powerfully to vitiate the air of the place. The mode of effecting this must be adapted to the nature of the articles to be purified, and the depth of their contamination. "In all cases and kinds of cleansing," says Dr. Caldwell, "the only means to be confidently relied on are pure air, pure water, soap, sand, brushes and sponges, or cloths, to wipe with. These agents, skilfully applied, are competent to the cleansing of all articles worth preserving; and fire alone can purify the rest." We believe, however, that fumigation with the acids and chlorides, perhaps sulphur, is important, where *fomites* are suspected. But the process of purification should depend on the circumstances of the case, as well as the period of detention. For this reason, they cannot be specified, but should, in all cases, be left to the judgment of the health officer. "Vessels may accomplish all that is required," says Dr. Smith, the quarantine physician of Boston, "in three hours as well as three days, unless the circumstances are of a very marked character, requiring time for some anticipated develop-

ment of disease supposed to exist on board." In Baltimore no vessel has been detained over four days, for the last twenty years, except in cases of smallpox. In the port of Boston no vessel is required to stop at the quarantine ground at all, but is piloted directly before the city, where it is inspected. If the crew are well, and have been so during the voyage, and the bill of health speaks favourably of the public health at the port of departure, the vessel is allowed to approach the wharf and discharge, without any reference to the kind of cargo on board, although the inspectors are not allowed to permit any thing to leave the ship in a damaged condition. The sick are sent to the different hospitals, according to the nature of their complaints, if they have neither friends nor homes; if they have either, they are permitted at once to leave the vessel and go to them. Infectious cases only are subject to quarantine detention, as smallpox, ship fever, &c. Damaged goods are sent to the quarantine to be aired, dried, washed, cleansed, &c., as circumstances require. Vessels are sent there when there is a prospective danger from them, if permitted to remain in the city, but not without. Hides, skins, hair, wool, rags, carpets, feathers, &c., are landed freely at all times of the year, and with perfect immunity. Under this system, which is based on common sense principles, there has not been a case of yellow fever in Boston in the last twenty years. We regret that the quarantine regulations of our own port (New-York) are not equally judicious. For example, according to the recent revision of our health laws, "Vessels arriving at the port of New-York shall be subject to quarantine as follows: All vessels direct from any place where yellow, bilious malignant, or other pestilential or infectious fever existed at the time of their departure, or which shall have existed at any place, and proceeded thence to New-York, or on board of which, during the voyage, any case of such fever shall have occurred, arriving between the first day of May and the first day of October, shall remain at quarantine for at least thirty days after their arrival, and at least twenty days after their cargo shall have been discharged, and shall perform such farther quarantine as the health officer shall prescribe." We doubt whether a physician can be found in the United States who will say that such a regulation as this is necessary.

In all our other Atlantic ports detentions of more than four days are rarely required. We have yet to learn what evils have arisen from the practice. The Board of Health of Philadelphia have power to detain a vessel at the lazaretto not exceeding twenty days, if it appear that it has come from a port at which a malignant disease prevailed; but this is rarely done. In Baltimore the whole subject is left to the discretion of the health officer, and so, also, in Charleston and Savannah. Our limits do not allow us to go into greater detail. In conclusion, we say, with Prof. Caldwell, "in every sanatory establishment a hospital should be included, as well as suitable buildings, grounds, and apparatus for cleansing and storing goods and merchandise. Into the former should be received all sick persons arriving on board of ships, and sailors who may sicken in port; not because they would endanger the health of the city by being lodged and attended elsewhere, but because their accommodations and chance of recovery might not be so good. The healthy portions of the crews and passengers of sickly ships may go on shore immediately, free from all restraint, care being taken that their persons and clothes are clean. No filth, however small in quantity, should be conveyed into the city from without. Under the best-regulated police, every crowded place of commerce has filth enough of its own. Let ships, cargoes, hedding, persons, and wearing apparel be thus purified, and all other necessary measures be pursued to enforce domestic cleanliness and prevent the formation of malaria, and the dread of imported pestilence may be safely dismissed."}

Bibliog. and Refer.—*T. Gibson*, A Treatise behovefull to preserve the People from Pestilence, &c., 4to. Lond., 1536.—*L. Fioravanti*, Regimento della Peste, 8vo. Ven., 1565.—*F. Hering*, Certain Rules, &c., for the Prevention of the Plague, 4to. Lond., 1625.—*J. du Chesne*, La Peste recognue et combatue; ensemble la Reformation des Theriâques et Antidotes opiatiques, &c., 12mo. Paris, 1631.—*Anon.*, Certain necessary Directions as well for the Cure of the Plague as for preventing the Infection, 4to. Lond., 1636.—*J Guastaldi*, Tractat. de Avertenda et Profligandâ Peste urbem invadente, &c., fol. Bologna, 1684.—*L. A. Muratori*, Del Governo della Peste, e della Maniera di guardarsene, trattato Politico, Medico, ed Ecclesiastico, 8vo. Milan, 1721.—*J. Browne*, Antidotaria, or a Collection of Antidotes against the Plague, 8vo. Lond., 1721.—*M. Pestalossi*, Avis de Précaution contre la Maladie Contagieuse de Marseilles, &c., 12mo. Lyons, 1721.—*J. Colbatch*, A Scheme for proper Methods to be taken, should it please God to visit us with the Plague, 8vo. Lond., 1721.—*T. Lobb*, Letters relating to the Plague and other Contagious Diseases, containing Rules for a suitable Management when that Sickness shall be brought into a City, Army, or Navy, and proper Preservatives from it, &c., 8vo. Lond., 1765. (*A singular, somewhat curious, and yet a good book.*)—*E. Langier*, L'Art de faire cesser la Peste, &c., 8vo. Paris, 1784.—*J. P. Papon*, De la Peste; ou Epoques mémorable de ce Fleau, et des Moyens de s'en préserver, 2 tomes, 8vo. Paris, 1797.—*A. B. Granville*, A Letter, &c., on the Plague and Contagion, with reference to the Quarantine Laws, 8vo. Lond., 1819.—*L. J. M. Thomas*, Guide Sanitaire des Gouvernens Européens, ou Nouvelles Recherches sur la Fièvre Jaune et le Cholera Morbus, &c., 2 tomes, 8vo. Paris, 1826.—*F. E. Fodéré*, Leçons sur les Epidémies et l'Hygiène Publique, t. iv., p. 167.—*Pariset*, Annales d'Hygiène Publiq., t. vi., p. 243, Paris, 1831.—*D. Barry*, in Lond. Med. and Phys. Journ., vol. lxiv., p. 476.—*J. Copland*, Of Pestilential Cholera, its Nature, Prevention, and Curative Treatment, 8vo. Lond., 1832, p. 95.—*Lagasquie*, Recherches sur l'Origine de la Peste, et les Moyens d'en prévenir la Developpement, 8vo. Paris, 1833.—*Segur—Dupeyron*, Recherches Historiques et Statistiques sur les Causes de la Peste, 8vo. Paris, 1837.—*J. Bowring*, Observat. on the Oriental Plague, and on Quarantines as a Means of arresting them, 8vo. Edin., 1838.—*A. Holroyd*, The Quarantine Laws, their Abuses and Inconsistencies, 8vo. Lond., 1839.—*E. Lefèvre*, Essai Critique contre les Adversaires de la Contagion par Infection appliqué à la Peste, Alexandria, 8vo, 1838; et Propositions sur la Cause et la Contagion de la Peste, 8vo. Alexand., 1839.—Reports of the Commissioners for inquiring into the State of large Towns, &c., 4 vols., 8vo. London, 1845.—*G. Milroy*, Quarantine and the Plague, &c., 8vo. Lond., 1846; and Med. and Chirurg. Review, No. 90, p. 286.—*A. White*, On Plague and Quarantine, &c., 8vo. Lond., 1846. See, also, the Bibliography *to the several Articles on Pestilence.*

PHARYNGITIS. See Throat, Diseases of.

PHLEBITIS. See Veins, Inflammation of.

PHLEGMASIA ALBA DOLENS.—Synon.—*Phlegmasia Dolens*, Hull. *Phlegmasia Lactea*, Levret. *Ecchymoma Lymphatica*, Parr. *Anasarca Scrosa*, Cullen. *Ecphyma Œdematicum*, Young. *Sparganosis Puerperarum*, Good. *Phlebitis Cruralis*, Davis, Lee. *Cruritis*, Hosack. *Œdema Lacteum*, *Metastasis Lactis*, Auct. Var. *Œdème des Nouvelles Accouchées*, *Dépôt laiteux*, French. *Milchstreichen*, Germ. *Crural Phlebitis, swelled leg of Lying-in Women; Pucrperal tumid leg.*

Classif.—III. Class, I. Order (*Author*).

Defin.—i. Nosolog. Defin.—*Painful and tense swelling of one or both legs, attended by fever, and running an acute and definite course, occurring most frequently after delivery.*

2. ii. Patholog. Defin.—*Inflammation or obstruction, or both, of the veins, lymphatics, and lymphatic glands, sometimes attended by inflammation of the adjoining nerves, most frequently occurring after delivery; but sometimes appearing independently of the puerperal states, and consecutively of other diseases, mechanically or otherwise implicating the veins, absorbents, and nerves of a limb.*

3. Having sometimes met with this disease in various circumstances as the sequela of other maladies, independently of the puerperal states, I have not considered it under the head of Puerperal Diseases. Whether occurring after delivery, or in other circumstances, it evidently does not present the same appearances and symptoms in all instances; and in fatal cases the morbid changes are also not always the same. Owing to these causes, opinions have lately differed widely as to its nature, and to these opinions I shall more particularly refer.

4. I. History.—This affection was first noticed by Roderic a Castro and Wiseman; but Mauriceau first described its symptoms, and referred them to pathological states. He appears to refer many of the symptoms to the femoral nerve; but Dr. Lee supposes him to have mistaken the femoral vein for the nerve. Puzos and Levret subsequently described the disease, and considered it to proceed from metastasis of the secretion of milk. The former states that it is a painful and sometimes fatal malady, occurring frequently about the twelfth day after delivery, although sometimes as late as the sixth week. The description of Levret coincides with that of Puzos, and both refer the disease to the crural vessels; especially in their accounts of the symptoms, although they view it as proceeding from a "depôt de lait." According to Mr. Cruickshanks, Dr. William Hunter did not subscribe to the opinion of Puzos, and did not view it either as a metastasis of the milk, or as a cold of the limb, as it was considered by some. Mr. Trye published, in 1782, an essay on the disease, in which he referred the symptoms to rupture of the lymphatics as they cross the brim of the pelvis under Poupart's ligament. Mr. White soon afterward published on this affection, and suggested the opinion that it depends on obstruction, detention, and accumulation of lymph in the limb, or some other morbid condition of the lymphatic glands and vessels of the part. Mr. White saw fourteen cases, but they all recovered. Dr. Ferriar next maintained that the disease proceeded from inflammation of the absorbents. In 1800, Dr. Hull published an essay on phlegmasia dolens, in which he showed that all the phenomena could not be explained by referring them to inflammation of the lymphatics only; he therefore viewed them as the results of an inflammatory state of all the textures of the limb —of blood-vessels, lymphatics, glands, nerves, cellular and muscular tissues, causing an effusion of serum and coagulating lymph; but he furnished no case in which the appearances observed on dissection supported this view.

5. It is a remarkable circumstance, as Dr. R. Lee has remarked, that nearly a century and a half should have elapsed since the time when this disease was pointed out by Mauriceau, before the precise nature of it was attempted to be ascertained by dissection. There had been opportunities to determine the accuracy of the different opinions advanced as to its nature and origin, but these were neglected until 1817, when Dr. Davis examined the body of a patient who died of it; and the appearances were described by Mr. Lawrence. The left lower extremity was œdematous, without external discoloration from the hip to the foot, owing to effusion into the cellular tissue. The inguinal glands were a little enlarged, but pale-coloured. The femoral vein, from the ham upward, the external iliac, and the common iliac veins, as far as the junction of the latter with the corresponding trunk of the right side, were distended and firmly plugged with what appeared externally a coagulum of blood. The femoral portion of the vein, slightly thickened, and of a deep-red colour, was filled with a firm bloody coagulum, adhering to the sides of the tube, so that it could not be drawn out. As the red colour of the vein might have been caused by the red clot everywhere in contact with the vein, it cannot be deemed a proof of inflammation. The trunk of the vena profunda was distended in the same way as the femoral vein; but the saphæna and its branches were empty and healthy. The substance filling the external iliac and common iliac portions of the vein was like the laminated coagulum of an aneurismal sac. The tube was completely obstructed by this matter, more intimately connected to its surface than in the femoral vein; adhering, indeed, as firmly as the coagulum does to any part of an old aneurismal sac; but in its centre there was a cavity containing about a teaspoonful of a thick fluid of the consistence of pus, of a lightish-brown tint, and pultaceous appearance. "The uterus, which had contracted to the usual degree, at such a distance of time from delivery, its appendages and blood-vessels, and the vagina, were in a perfectly natural state. There was not the least appearance of vascular congestion about the organ, nor the slightest distention of any of its vessels. Its whole substance was pale, and the vessels everywhere contracted and empty." (*Transact. of Med. and Chirurg. Society*, vol. xii., p. 427.)

6. An essay was read by Dr. Davis, on the 6th of May, 1823, to the Medical and Chirurgical Society, with the object of proving that the proximate cause of the disease, called phlegmasia dolens, is an inflammation of one or more of the principal veins within, and in the immediate vicinity of the pelvis, producing an increased thickness of their coats, the formation of false membranes on their internal surface, a gradual coagulation of their contents, and occasionally a destructive suppuration of their whole texture; in consequence of which the canals of these vessels are so much diminished, or so totally obstructed, as to be incompetent to the circulation of blood through them. He first notices a case by J. G. Zinn (*Comment. Soc. Reg. Götting.*, t. ii., p. 364, 1753), in which dissection disclosed an enlarged and indurated state of the inguinal glands of the affected limb, surrounding the crural vein, and diminishing

the diameter of this vessel; and next adduces the case, the post-mortem appearances of which I have noticed as described by Mr. Lawrence; and, in addition to the cases which he had himself observed, he mentions a case communicated to him by Mr. Oldknow, in which inflammation of the iliac veins was present; and "the absorbent vessels and glands were slightly enlarged as high as the lumbar regions, but not otherwise affected." (P. 436.)

7. During the commencement of 1823, M. Bouillaud published several cases and dissections, in which the crural veins were obliterated in women who had been affected with swelling of the lower extremities after delivery; but Dr. Davis had been promulgating his views since the occurrence of his first case in 1817. Dr. Bouillaud distinctly states, in his instructive memoir on this subject, that he considers obstruction of the crural veins to be the cause not only of the œdema of lying-in women, but of many partial dropsies; and he adduces instances of this obstruction being caused both by disease of the vessel itself, and by tumours pressing upon the vessel. (*Archives Générales de Medicine*, t. ii., 1823.)

8. Soon afterward, M. Velpeau published some observations on this disease, and concluded as follows: 1st. The acute swelling of abdominal extremities of women after delivery has for its cause, at least in some cases, inflammation of the pelvic articulations, or of the veins. 2d. On the other hand, the symptoms observed in the living patients are referable as much to severe lesion of the deep-seated veins, as to that of the lymphatics. 3d. At present it remains to be shown whether or not these latter parts are really the cause of the phlegmasia alba dolens. 4th. Affections altogether different are ranged under the same name, causing confusion, and giving rise to obscurity in the writings of several physicians on the subject. Those cases adduced by M. Velpeau, and which occurred in the Parisian hospitals, are very interesting. In all of them there were marks of inflammation, with collections of pus, in the pelvic articulations or symphyses, in the uterine canals and veins (see case 2d), in the iliac and femoral veins, and in the lymphatics and glands. The whole of the memoir, and the observations appended to it by M. Andral, have not received, from more recent writers on the subject, the attention which they deserve. It should be added, that M. Velpeau considers the inflammatory appearances, and the purulent matters found in the veins and lymphatics, to be the consequences of the inflammation commenced in the pelvic articulations and uterine organs. (*Archives Génér. de Med.*, t. vi., p. 220.)

9. MM. Gardien and Capuron, somewhat earlier writers than those now referred to, regarded the disease as an inflammation of the lymphatic vessels and glands; and Dr. Dewees considered it to be inflammation occupying "exclusively the white lymphatic vessels (!) of the cellular membrane of the several textures of the limb." (*Dis. of Women*, p. 489.)

10. Dr. Burns believed, and with much justice, judging from some cases which I have seen, "the nerves to be implicated in the disease as much as the veins; and that while both may contribute, we shall find, in different cases, one or other predominate." (*Midwifery*, page 611.)

11. In April, 1824, I attended a case, with my friend Dr. Davies, now of Hertford, in which the symptoms indicated at the commencement considerable affection of the nerves of the limb; but those of vascular obstruction afterward predominated. (*Lond. Med. Repository*, vol. xxiii., p. 452.)

12. Dr. Davis, to whom the honour of originating the phlebitic pathology of phlegmasia dolens belongs, considered the inflammation to commence in the iliac veins. But Dr. Lee remarks, that Mr. Guthrie suggested to him the idea of tracing the affected veins to their origin in the uterus; and that, acting upon this suggestion, he ascertained that crural phlebitis is but an extension of uterine phlebitis. That the disease thus originates, in many cases, cannot be doubted. I have myself seen such cases, and Dr. Lee has observed many others. One of my cases, not, however, occurring in the puerperal state, was seen also by him. But, judging from the few I have seen, and from the descriptions of cases which have been published, I cannot come to the conclusions, either that the affection is a pure and uncomplicated phlebitis in all cases, although it may be in some, or that it always originates in the uterus, although it often does so originate. My views as to the pathology of this affection will appear more precisely in the sequel.

13. II. Description.—This disease attacks much more frequently the left lower extremity than the right. It very rarely commences in both limbs at the same time; but it sometimes passes over to the other limb, when it leaves the one first attacked. It generally appears within six weeks from delivery—most frequently between the fourth and fifteenth day; but it is not confined to the puerperal state. Dr. Lee states, that in eight of twenty-three cases of puerperal crural phlebitis seen by him, the disease commenced between the fourth and twelfth day after delivery, and in the remaining fifteen it appeared subsequently to the latter of these days.

14. i. Symptoms.—The pathognomonic symptoms of phlegmasia dolens are preceded, in some cases, by general febrile disturbance, and in others the local symptoms are the first to appear. In the former case the patient complains, from the period of delivery, of fever, which continues without a manifest cause; and in the course of a few days the swelling of the limb appears. In other instances, the swelling is preceded by severe rigours, which recur several times. In many cases, signs of peritonitis, or of inflammatory action of the pelvic viscera or parietes, are present before the symptoms of this affection are remarked, especially in the same side of the pelvis with the affected limb; and there is often a severe pain complained of in the iliac fossa of that side. In a few cases, however, the symptoms of phlegmasia alba dolens occur suddenly in one of the limbs, without pain or any other symptom in the abdomen or correspondent iliac region. In addition to uneasiness and pain in the lower part of the abdomen, or extending along the brim of the pelvis, the patient is weak, irritable, and depressed.

15. *a.* When the disease begins in the pelvis,

the *pain* soon extends below Poupart's ligament along the thigh to the ham, calf of the leg, and instep of the foot. Shortly afterward the inguinal region is tumefied and tense, and, in a day or two, the thigh becomes swollen, tense, white, and shining. When the pain commences in the calf of the leg, the swelling is first observed there, or at the ankles, gradually extending itself up the leg and thigh. In some cases, the pain ascends from the leg along the thigh to the groin, or even to the iliac region. In rarer instances, a considerable space intervenes between the situation of the pain, which, in this case, is usually felt in the inguinal region and in the leg, the thigh being exempt from pain.

16. The *character* of the pain varies greatly. In some it is merely a sense of numbness or stiffness, or a sort of cramp, or a painful feeling of tension. In others the pain is severe, burning, or shooting; and in several it is darting or lancinating, and so violent as to cause the patient to scream aloud. The slighter or duller pains are usually constant, but the violent shooting pains are remitting. The pains follow exactly the course of the femoral vessels, the darting violent pain being especially referable to the femoral nerve. In some cases the pain extends all the way from the iliac fossa along the thigh to the ham and calf of the leg. The whole surface of the limb is tender. Pressure at any part, but especially on the femoral vessels and nerves, remarkably aggravates the pain. The least motion of the extremity, more especially extension, greatly increases the pain; the easiest position is that of partial flexion. Aggravation of the pain on pressure is sometimes only felt in a limited portion or spot, as in the groin, or popliteal spot, or calf of the leg.

17. *b.* The *swelling* generally occurs after the pain has existed a short time—usually after a period varying from twelve to thirty-six hours. In some instances the swelling appears nearly contemporaneously with the pain, and it usually commences in the same situation as that in which the pain is at first felt. In the majority of cases it proceeds from above downward, implicating successively the hip, nates, and labium pudendæ; the thigh and leg. Casper, Callisen, Fraser, and Raige-Delorme mention instances in which the swelling extended also upward to the flank and trunk, so as to reach the upper extremity of the same side. In some cases it begins in the foot, and rises more or less rapidly until it invades the whole extremity, the nates, vulva, and iliac region; but Puzos, Levret, White, Gardien, and other writers consider the descending character of the swelling as pathognomonic of the disease. The swelling is sometimes so great that the affected limb is double the healthy size. When it is advanced it is generally uniform, but it is sometimes more remarkable on the inside of the thigh, and near the knee. In the early stage of the disease, and while the acute symptoms continue, the swelling is tense, and does not pit after pressure; it is generally at a later period that pitting from pressure is observed.

18. *c.* The *colour* of the limb is commonly a pearly white. In some, reddish lines are observed chiefly in the course of the vessels; and in others only small red spots or points. In cases observed by Dr. Lee and M. Salgues, dark vesicles and phlyctenæ were observed; and in a case terminating in gangrene, under the care of Dr. Davies, and also seen by me, the usual discoloration of the skin in such circumstances was observed. In most instances the *temperature* of the affected limb is increased, especially on the inner aspect, and at the earlier periods; but sometimes, as Dr. Burns has remarked, it is diminished, particularly at an advanced stage. Gangrene, in the case just adverted to, was preceded for several days by great coldness of the limb. Most writers have remarked the existence of a *nodulated chord*, very painful on pressure, descending from the crural arch more or less down the thigh. This chord may be only barely perceptible, or very remarkable, from the thickening and infiltration of the cellular tissue surrounding the vessels. In some cases it descends considerably down the thigh, and may even be detected in the popliteal space. It is not easily detected when the swelling and pain are great, and it is chiefly when the more violent symptoms have subsided that it can be best ascertained. The pain and tenderness are always greatest in the course of this chord, or in its immediate vicinity.

19. *d.* Enlargement of the *glands* in the groin, and even of those of the ham, is often observed during life, and found after death. In some cases, as observed by Casper, red lines are traced along the surface in the direction of the tumefied and tender glands. The nodosities frequently found in the course of the vessels are attributable, in some situations and cases, to enlargement of the glands; and, in other places and instances, to the induration and inflammation of portions of the cellular tissue surrounding the inflamed vessels; or to thickening of the coats of the vessels, and to coagulation of the blood below the seat of obstruction. As observed, also, in the first case, in which a dissection was made after death, the tumours may arise both from enlarged lymphatic glands, and from the distention of the vein below the seat either of compression by these glands, or of obstruction by disease of the vessel itself.

20. *e.* The *constitutional symptoms* are often very remarkable, even before the local mischief is much complained of. In most cases, weakness, depression, irritability of the pulse, diminished or disordered lochia, diminution of the secretion of milk, want of sleep, and disorder of the digestive and excreting functions immediately precede and accompany the accession of the local disease. As this becomes developed, the pulse, hitherto weak, quick, or sharp, becomes rapid, often 130 or 140 in a minute, and small and feeble; the appetite is lost, the tongue is white or loaded, the thirst is increased; the bowels are confined, and the stools unhealthy, but they are sometimes loose, fetid, or bilious; the urine is turbid, and the lochia is often diminished or suppressed, or offensive. The patient is restless, sleepless, and irritable, or morbidly sensible. The countenance is generally pale, and sometimes evincing marked anæmia. There are frequently indications of disorder of the uterine organs, or of disease of the pelvic viscera or parietes. The vulva and vagina are tender; and pressure above the pubis is seldom made without pain. The os uteri is sometimes partially open and

soft. At the commencement of the disease, the skin is generally hot and dry; but it sometimes becomes moist, or perspirations break out. The secretion of milk is often altogether suppressed or much diminished. In very severe cases, the febrile disturbance is not only attended by sleeplessness, but followed by delirium. In some instances, in which the disease supervened in the other limb, as it subsided in the first affected, the cerebral symptoms were very urgent. In two cases which were under my care, one of which was attended also by Dr. Lee, constant low delirium, followed by coma, came on; but the patient ultimately recovered.

21. ii. Terminations. — The disease may terminate variously: 1st, *by resolution.* When it terminates in this way, the *acute symptoms* subside in the course of from twelve to twenty days, generally in the order of their appearance; the pain ceases, the swelling disappears, and the use of the limb returns. As the swelling begins to subside, it pits more readily on pressure; and, in many cases, the tumours and chord, in the situations already mentioned, are more distinctly felt, and in some the superficial veins are dilated, or irregularly enlarged, not only in the limb, but also, as stated by M. Raige-Delorme, in the flank and parts adjoining. As the resolution proceeds, the constitutional symptoms subside. Resolution takes place much more gradually and slowly when obstruction of the femoral is present. The swelling then continues sometimes for months, in a less degree, and thus becomes *chronic*, the patient being hardly able to use the limb. In these cases, thickening of the cellular tissue surrounding the vessel often exists, and a varicose state of the veins takes place and remains. 2d. *Suppuration*, according to Petit, Capuron, and Churchill, takes place in rare instances, generally in the tract of the large vessels, or situation of the lymphatic glands. This result obviously proceeds from the inflammation of those vessels having extended to the surrounding cellular tissue and passed on to abscess. 3d. The disease still more rarely terminates in *gangrene.* M. Gerhard has adduced a case in which this occurred; and Dr. Davies has published the details of another, which was also seen by me on several occasions. In this case gangrene of the leg and foot was followed by sloughing, and the parts were amputated by Dr. Davies above the knee, the thigh being at the time about double the thickness of the opposite one. As soon as the vessels were divided, the blood in the veins was observed quite coagulated. A considerable quantity of serum was discharged from the surface of the stump as soon as the leg was removed. (*London Med. Repos.*, vol. xxiii., p. 454.)

22. 4th. *Death* sometimes takes place, generally owing to the severity of the several changes which supervene in the course of the disease. It may occur suddenly, as remarked by Denman, Burns, and Blundell, owing chiefly to exhaustion consequent upon previous losses of blood, and upon the violence of the constitutional and nervous symptoms, especially if the patient makes any exertion in this state, or raises herself up too quickly in bed. It most commonly, however, takes place consequently upon the organic lesions found in the pelvic viscera and parietes; such as inflammation and purulent formations in the uterus, ovaria, and pelvic articulations, with similar changes and coagulations of blood in the iliac veins. In these cases, death is the result of contamination of the circulating fluids, and is generally preceded by a very rapid, small, and feeble pulse, by distressing feelings of sinking, by delirium, sometimes coma, and various nervous phenomena.

23. iii. Appearances after Death.—On dissection, the limb is seen infiltrated with serum and lymph. Several small abscesses are disseminated through the cellular tissue, between the muscles, or one or two considerable abscesses are formed in the vicinity of the large vessels, especially in the iliac, inguinal, and popliteal regions. The sub-peritoneal cellular tissue, particularly that of the meso-rectum and iliac fossæ, is sometimes infiltrated with a sero-purulent matter. The articulations of the affected limb, and even the joints at a distance from the seat of the affection, although much more rarely, are occasionally the seats of suppuration. Purulent collections have also been found in the liver and lungs. A sero-puriform effusion has sometimes taken place in the pelvic cavity, and in the cavity of the pleura. These lesions are secondary, and the consequences of the phlebitis, constituting the chief pathological condition of the malady.

24. *A.* The researches of Dr. Davis, Dr. R. Lee, Dr. Davies, and others, have fully shown the great extent to which the *veins* of the limb, and very frequently also those of the uterus, are affected in this malady. The femoral vein is always more or less diseased. It is inflamed, its parietes are thickened, and its canal is obstructed by fibrinous coagula, in the centres of which puriform, or a brownish grumous, matter is often found. In rarer cases a fibrinous false membrane is observed adhering to the interior of the vessel. The same changes may be traced along the profunda and popliteal vein, to most of the veins of the extremity. The phlebitis may be so general in the limb, that a puriform matter escapes from all the small veins upon dividing them. In many cases, however, the saphena remains unaffected. The same lesions as exist in the femoral vein are also generally observed in the external iliac of the same side, and often extend to the hypogastric or internal iliac. In this latter case the veins of the vagina, of the neck and body of the uterus, and of the ovaria and tubes, and, indeed, most of the branches which contribute to the hypogastric, present the usual appearances of inflammation, on the same side with that affected. In many cases the same lesions are found in the veins of both sides of the uterine organs, but they extend not so far as the internal iliac of the unaffected side. In some instances the inflammation extends not only to the common iliac, but also to the vena cava, and in rare instances as far as the emulgent veins. M. Raige-Delorme remarks, that the alteration may even be traced to the right side of the heart; but this can be possible only in rare instances.

25. When the disease has existed in both extremities, the phlebitis in the pelvic and uterine organs extends along both hypogastric veins to the external iliacs and femoral veins,

&c.; it has even been observed in the lower portion of the vena cava. It has been supposed that the supervention of the disease in the other limb, as that in the first attacked subsides, is produced by the extension of the inflammation from the common iliac of the one side to the vena cava, and to the common iliac of the other side; hut the inflammation of the uterine veins may extend to both limbs, although not at the same time, without passing to and from the vena cava. M. Raige-Delorme refers to two cases in which phlebitis supervened in the brachial, cephalic, and cubital veins in the course of this disease.

26. *B.* The *lymphatic glands* and *vessels* are frequently also found inflamed; but where this lesion coexists with phlebitis, it is difficult to determine which of the two is primary. They are probably contemporaneous in their development and course. In the account of the first *post-mortem* examination of the disease on record, Zinn states, that the *inguinal glands* were greatly enlarged and indurated, and that they surrounded and very much diminished the diameter of the crural vein. The glands of the groin and ham are often enlarged, injected, and sometimes in a state of suppuration; hut purulent matter is more frequently found in the cellular tissue surrounding them than in the glands themselves. Raige-Delorme states that the glands in the iliac fossæ sometimes present various degrees of inflammation, which has also extended to the mesenteric glands.

27. *C.* The *lymphatic vessels* have been frequently overlooked in dissections of the affected limb. Bouillaud states that inflammation of these vessels has been ascertained in a considerable number of cases of this disease. MM. Tonnellé, Duplay, and Nonat have also confirmed this view. M. Albonneau (*Journ. Comp. du Dict. des Scien. Med.*, t. xxxviii., p. 10) has recorded a case in which "the superficial lymphatics of the thigh presented a deep red colour, were enlarged and tortuous, the veins being also inflamed on the same side as high as the vena cava." Dr. Churchill remarks, that pus and evidences of inflammation are sometimes met with in the absorbents.

28. *D.* The *nerves* are probably also more frequently implicated than they have lately been supposed to be, particularly since attention was more especially directed to the veins. In the interesting case published by Dr. Davies, the symptoms, which were very violent in their accession, were referable to the femoral nerve; and M. Dugès has adduced several cases showing that neuritis actually forms a part of the lesions observed in this disease.

29. *E.* Alterations of the *uterus*, and especially of the *veins of the organ*, have been much insisted upon by Dr. Lee as the points of departure in the succession of morbid phenomena constituting this complex malady. Although M. Velpeau appears to have been among the first to describe lesions of the uterus and its veins, in examinations of this disease after death, still Dr. Lee first insisted upon the connection, and upon the circumstance of the phlebitis being propagated from the uterus or its appendages to the hypogastric, iliac, and femoral veins. Inflammation of the veins and canals of the uterus, puriform matter in them, or in the walls of the uterus; softening of the organ; membranous exudations on its internal surface; softening, dark discoloration, and marks of inflammatory action, more especially at the part where the placenta was attached; puriform collections in the ovaria, &c., have been very frequently observed. Dr. Burns, however, remarks that the uterus is sometimes found quite healthy. Besides these lesions, M. Velpeau has shown that the adjoining pelvic viscera may be also more or less implicated, especially the sacro-iliac and pubic symphyses, the cartilages and ligaments of which are loosened, softened, and bathed in pus; but these lesions are not so frequent as those of the uterus and its appendages.

30. II. Causes.—*A.* This disease has not been observed with due precision in respect of its remote causes, and particularly as to those which *predispose* to the origination and extension of the several lesions recognisable during life and found after death. The much more frequent occurrence of the affection during the six weeks immediately following parturition evidently proves that the changes more especially connected with that period are more or less concerned in producing it. The pressure which the gravid uterus exerts upon the nerves, blood-vessels, and other parts within the pelvis during the latter months of pregnancy, the violence which these parts often sustain during parturition, the sudden removal of the pressure, and the changes in the state of nervous function and of circulation consequent on the removal, altogether remarkably predispose to the supervention of the affection, especially when aided by other circumstances. But the disease may occur during pregnancy. Puzos treated three cases before the period of parturition; and in these, as well as in others met with at this period, it is reasonable to infer that the pressure was chiefly concerned in producing it in these instances, and that uterine phlebitis was not its point of departure.

31. As far as my own observation enables me to judge, aided by the histories of many recorded cases, constitutional debility and delicacy of frame; the exhaustion consequent upon protracted, difficult, or instrumental labours; hæmorrhage during or after parturition; and anæmial and cachectic states of the system, are among the most influential predisposing causes of this affection. Females subject to leucorrhœa, especially during pregnancy, appear also to be more liable than others to an attack.

32. *B.* The *exciting causes* are, in the great majority of instances, those of uterine phlebitis. The use of instruments during labour, injury of the organ, the retention of portions of the placenta, the means taken to remove it; the retention of coagula, or of the lochial discharge in the uterine cavity or vagina, owing to deficient contractile power; imperfect contraction of the uterine canals and veins admitting of the retention, and consequent alteration, of their contents; the passage of the retained and altered lochia from the cavity of the uterus into the uterine veins; inflammation of, and purulent collections in, the parietes of the uterus or in the ovaria, giving rise to inflammation of the veins of these organs; inflammation of the vagina, or of any of the pelvic articulations, are the most frequent exciting

causes of phlegmasia dolens. These local conditions and changes, in the great majority of cases in which they take place, either proceed no farther, or give rise to other secondary maladies than this; but, when the predisposition is marked, and when other causes re-enforce these, the affection will be induced, and may occur, although in rare cases, even when the uterine lesions are not present.

33. There can be no doubt that, when the lochial discharge is not freely thrown off, in weak or exhausted females, or after copious losses of blood, and when morbid secretions form in the uterus or ovaria, in these states of the system absorption of these matters, either by the lymphatics or veins, or by both, will then take place more readily and abundantly than in other circumstances, the matters thus absorbed inflaming the vessels and contaminating the fluids. Causes producing a suppression of the lochia, or of the secretion of milk, may also occasion the supervention of crural phlebitis, and even of inflammation of the absorbents, by favouring the absorption of excrementitial matters; and thus the old doctrine of the metastasis of these secretions, although not strictly applicable to these cases, is not, in some respects, very wide of the truth.

34. Exposures to cold, wet, and to currents of air, insufficient clothing, and unwholesome, heating food and beverages, especially spirituous liquors, are evidently concurring, if not exciting causes. Probably more importance has sometimes been attached to the influence of cold than it deserves; but where the cold is applied directly to the limb—where the lower extremities are not sufficiently protected from it, or where the patient wears damp shoes, &c., particularly upon getting about soon after parturition, the injurious influence may not be local only, but extended to several of the excreting functions; and, although it may not be sufficient of itself to produce the disease, it may powerfully aid the operation of other causes, or favour the extension of morbid changes existing in the uterine organs, or parts in the vicinity, to the iliac and femoral veins, or also to the nerves and absorbent vessels.

35. iii. Phlegmasia Alba Dolens, unconnected with the Puerperal States.—An affection, or rather a complex disease, in every respect similar to that now described in connexion with the puerperal states, may occur in *women independently of these states*, and even in the *male sex*; but in every instance which I have seen of this description, amounting in all to nine, of which I have taken notes, it has been contingent upon some other dangerous disease, and has presented the same changes of structure in the limb as those which I have described above (§ 24, *et seq.*). The diseases upon which it has supervened in my practice are the following: Inflammation of the uterus; hysteritis complicated with dysentery; cancer of the mamma (two cases); tubercular consumption; typhoid fever; iliac abscess (two cases); malignant ulceration of the mouth and neck of the uterus, and injury of one of the upper extremities. The injury in this last instance of the affection was soon followed by inflammation of the lymphatics and veins; the patient, however, recovered.

36. The case of the disease following hysteritis occurred in 1831, in a lady who had not been pregnant in three or four years. The affection commenced in the right thigh, and extended to the left as it began to subside in the right. The patient had shortly before experienced a smart dysenteric attack, which was followed by inflammation of the uterus, and for each of these she had been moderately blooded. The disease of the extremities was most severe, and was attended by dangerous constitutional symptoms. As the case well illustrated Dr. R. Lee's views of the pathology of the disease, I requested him to see her. Delirium, sopor, and great nervous exhaustion supervened, but followed the very rapid subsidence of the swelling of both extremities, which had reached as high as the flanks. She was very remarkably benefited by nervous and restorative remedies, and recovered very rapidly. I have seen her very frequently since, and as recently as the day of my writing this; but there was never any evidence of enlarged veins or swelling about the ankles subsequent to the attack; the appearances of the limbs, up to this time, now fifteen years, being in every respect the same as before.

37. In the other case there were both hysteritis and dysentery; indeed, the whole pelvic viscera appeared simultaneously attacked. This person, the wife of a publican, had never been pregnant; only one extremity was affected; but low fever, with muttering delirium, coma, and destructive inflammation of one eye, supervened, and she died, the other eye also becoming affected shortly before death.

38. In both the cases of carcinoma mammæ, the arm on the affected side was enormously swollen, painful, and tender, but not discoloured. One of the cases was that of a lady attended by Dr. Young and myself. She was only thirty-five years of age, had borne several children, and was then pregnant. Great enlargement of the lymphatic glands had taken place, and obstruction both of the lymphatic and of the venous circulation obviously existed. This lady, who was far advanced in pregnancy when the affection of the arm supervened, was delivered nearly at her full time of a child about one fourth the usual weight; she died, as was expected, shortly afterward. The other case occurred in a person advanced in age, and was in all respects similar as regarded the local disease. In neither instance was an examination after death allowed.

39. The case contingent upon tubercular consumption, of which I have notes, and which was a remarkable instance of the affection, presented, upon dissection, tubercular deposites in the inguinal glands, with great enlargement; obstruction of, and coagulation of blood in the femoral and iliac veins, the centres of the coagula consisting of a grumous, soft, or pultaceous brown matter. There had been, also, diarrhœa and ulceration of the bowels; but the veins were not traced from the iliac to the ramifications to the pelvic viscera; and it was hence not manifest whether or not the disease of the veins was caused by ulceration in the lower bowels, or by the morbid state of the blood consequent upon the absorption of purulent and tubercular matters. I have seen other cases of great swelling of one or both lower extremities, consequent upon phthisis; but I

have had an opportunity of examining after death only the one now mentioned. My recollections of the others are such as to lead me to infer that the obstruction in the veins of the lower extremities was the consequence chiefly of the morbid states of the blood, aided by the physical conditions of the limb—the sitting posture, and the remora of the blood in the veins, owing to this posture, and to the influence of gravitation; and that these states favoured coagulation of blood in the veins, or inflammation of their internal surface.

40. Instances of phlebitis, in the course of low or typhoid fevers, are not rare. I have, however, met with only one in my own practice. In this case there was certainly no evidence of ulceration of the lower bowels. The disease of the veins is to be referred chiefly to the state of the blood, and to some local physical conditions, or causes acting locally. Drs. Graves and Stokes have related instances of this contingent form of the affection. They remarked that the œdema was unattended by redness, but accompanied with pain, tenderness, increased heat, and impaired motion of the limb.

41. The first case of the disease contingent upon iliac abscess occurred to me in 1821, in a groom, a patient of the South London Dispensary, when physician to that institution, and was attributed to the pressure of the collected matter upon the iliac nerves and veins, and probably, also, upon the lymphatics. A more recent case was entirely similar, and both terminated fatally soon afterward, but inspections were not permitted. There can be no doubt of the occasional occurrence of this malady during organic changes in the uterus and ovaria, occurring independently of parturition, and more especially if these changes are attended by the absorption of morbid secretions from these organs. Dr R. Lee has adduced several instances of this source of the disease. Sir H. Halford has recorded two cases, which consisted chiefly of inflammation of the veins arising apparently from exposure to currents of cold air; and, in one case, from such exposure being in the standing posture. Many years ago I met with a case which originated in this cause; but the patient was of a cachectic habit of body; recovery, however, took place without any unfavourable occurrence. It is not improbable that, during an impure or morbid state of the blood, connected with debility and a languid state of the circulation, the remora of the blood in the veins of the lower extremities, favoured by position or other physical causes, will occasion either partial spontaneous coagulation, or an inflammatory state of the coats of the vessel, more especially if pressure have existed on the trunk of the veins. Hence the occasional appearance of this affection in the advanced progress of many other diseases, especially of those in the course of which morbid secretions are apt to pass into the circulation, or to be absorbed by the lymphatics, and when pressure has existed upon, or has been suddenly removed from, large veins. (*Veins, Diseases of.*)

42 IV. Nature of the Disease.—*A.* I have already noticed (§ 4, *et seq.*) some of the opinions formerly entertained respecting the nature of this complex affection, and stated enough to show that most of these were more or less erroneous, but chiefly in their limitation to one only of the several morbid conditions generally present in the fully-developed cases of the disease. Since the days of White, who attributed the malady to rupture of the lymphatics, most writers up to the end of the last century believed it to be an inflammation of the lymphatics. Boyer, Trye, Denman, Ferriar, and Gardien adopted this opinion, with certain shades of difference. Thus Trye considered that the inflammation of these vessels proceeded sometimes from pressure of the gravid uterus, sometimes from an acrid matter secreted by this organ; while Denman supposed that it originated in the lymphatic glands of the groin; and Ferriar that it commenced in the lymphatics of the thigh. Many of the symptoms observed during life, and even part of the changes detected after death, evince that these views were not entirely without foundation. They wanted the support derived from post-mortem research; and they constituted only a part of the morbid changes; they were merely a substitution of a part, and often only a small part, of the malady for the whole.

43. Much more recently, certain symptoms, attracting the notice of pathologists, and more than ordinary attention being directed to these symptoms, and to their origins, a different opinion of the nature of phlegmasia dolens was suggested, and former views were thrown in the shade. Thus Albers (Hufeland's *Journal*, &c., Feb., 1807, p. 16) considered the disease as merely a form of neuralgia. He believed that it commenced in the nerves of the limb, and that the swelling was a consecutive lesion. That this is actually the case, at least in some cases, as in that recorded by Dr. Davies, in two or three cases seen by myself, and in others recorded by Dugès, Kruger, and other physicians, cannot be doubted. Dugès (*Revue Medicale*, t. iii., 1824); Siebold, Loewenhard (in Siebold's *Journal*, t. x, p. 352), Hankel (Rust's *Magazin*, t. xxiv.), and Kruger (Horn's *Archiv.*, t. iv., 1831) attributed the malady to inflammation of the nerves of the pelvis and thigh, or, at least, to a morbid state of the sensibility of these nerves, admitting, however, consecutive changes in the veins, lymphatics, and arteries of the limb.

44. Newmann and Treviranus (Siebold's *Journal*, t. xi., p. 253), on the other hand, considered this affection as an inflammation of the aponeurosis, or fascia lata, giving rise to an effusion of serum and lymph; while others even supposed it to be a form of rheumatism occurring in the puerperal state, and modified by the circumstances of this state. This opinion, supported by Himly and Reuter, is equally visionary with that of Newmann.

45. The researches of Dr. Davis first established inflammation and obstruction of the veins as the principal lesion of severe cases of this malady; and the investigations of Bouillaud, Velpeau, J. Davies, Boudaut, and R. Lee farther illustrated this doctrine. Dr. Lee first demonstrated the origination, of at least many of the cases of the disease, in lesions of the uterus and the veins of this organ, in uterine phlebitis. So that the prevailing opinion in the present day is, that *phlegmasia alba dolens* is inflammation of the iliac and femoral veins, originating in the veins of the uterus,

and often extending, on the one hand, to the common iliac veins, or even to the vena cava; and, on the other, to most of the veins in the extremity.

46. I believe, however, from considerable experience of the disease in different circumstances, that phlegmasia dolens is a more complex affection than it is generally now considered to be; that it is not always, at least, a simple crural phlebitis; that it does not always, although very frequently it does, originate in uterine phlebitis; that it is not uniform in character, phenomena, and progress; and that it is a much more complex disease than it is generally viewed to be.

47. *B. Pathological Inferences.—a.* The disease certainly consists chiefly of *inflammation* or *obstruction*, or of *both lesions*, of the *femoral and iliac veins*; but these, although the chief, or occasionally almost the only lesions, are not always such.—*b.* The crural phlebitis, even when manifestly existing, cannot always be referred to the *uterus* for its origin, although it very frequently does so originate, especially in cases occurring after delivery.—*c.* The lesions observed in the veins appear, in some instances, as consequences of prolonged pressure, or of this cause and the sudden removal of that pressure, the disease originating in the iliac and femoral veins.—*d.* The affection appears to commence, in some cases, in the *nerves*, owing to the causes just assigned, the veins becoming consecutively affected, or being contemporaneously attacked.—*e.* Cases occur in which it is difficult to determine whether the *veins* or the *lymphatic vessels* and *glands* are primarily or mainly implicated, the symptoms and the lesions observed after death being referable to both systems of vessels.—*f.* The disease may originate in lesion of any of the *pelvic viscera*, or of the articulations or parietes of the pelvis; and in such cases it may not be limited to either the *veins* or *absorbents*, but may affect the one or the other, and extend to both.—*g.* The disease may be unconnected with lesion of the pelvic viscera, and may commence in the veins, or in the lymphatics or veins, or even in the nerves, and extend more or less to these vessels, especially when the patient has had the extremity exposed to pressure or injury, or to cold or currents of cold air, or to other injurious physical agents.—*h.* The precursory, early, and advanced symptoms, the constitutional phenomena, and the terminations or consequences of the affection, vary according as either of the parts just pointed out as being implicated more or less, or any two or more of them, are prominently affected; the pain and nervous symptoms are more severe, the more the *nerves* are affected; the swelling, the general œdema of the limb, and the pitting on pressure, and the low or typhoid character of the accompanying fever, are more remarkable the more the disease is confined to the *veins*; and especially when it is preceded or attended by disease of the uterus, or of any other pelvic viscus or part; the hardness, tenseness, and heat of the limb; the tenderness of the surface, and its indisposition to pit on pressure, are more manifest the more the *lymphatics* and *glands* are concerned in the malady.—*i.* I have never met with a case of the disease in which the *arteries* were implicated.

48. V. Prognosis.—Although a small proportion only of those who are attacked with phlegmasia dolens terminates unfavourably, especially when the affection appears after parturition, still it should be viewed as a serious disease, and more particularly when it occurs in the course of other maladies which contaminate the circulating fluids. But the amount of danger should be inferred chiefly from the severity of the symptoms, from what is made apparent as to the cause and origin of the attack, and from the pathological condition manifested at the commencement and progress of the case. Pre-existing disease of the pelvic viscera or parietes; evidence of inflammation of the iliac and femoral veins; the extension of the malady to both extremities; low fever and delirium; a very rapid, soft, and small pulse, are severally indications of great danger.

49. The nature and amount of disease of the pelvic viscera, preceding and attending the attack, should always be duly estimated, as well as the nature and relations of it. When disease of the veins is detected, the extension of it to the common iliac and vena cava, and consequent contamination of the blood, are to be dreaded—changes which may be often prevented by judicious practice, but which, when once induced, can rarely be removed. The passage of the affection to the other limb indicates, at least, a severe lesion of the uterine or pelvic viscera, possibly even the extension of the venous disease to the vena cava. Low fever, delirium, sopor, and a rapid, soft pulse, evince contamination of the blood, and the injurious influence of this change upon the brain and nervous system, and constitution. The contingent occurrence of the affection in the course of other maladies is always a very grave, or even most dangerous circumstance; but the amount of that danger depends upon the nature of the primary disease. In malignant or cancerous maladies, in tubercular consumption, and even in some other constitutional diseases, the hopeless state of the patient depends more upon these than upon this super-induced affection, which, however, hastens the unfavourable issue.

50. VI. Treatment.—It is of the utmost importance to ascertain the predisposing and exciting causes of this affection; and the pre-existing pathological conditions, especially those so frequently implicating the pelvic viscera and parietes, before the indications and means of cure are adopted. Of the considerable number of cases in which I have been consulted, I have not met with one which did not occur consequently either upon large losses of blood from the uterus, or upon blood-letting, large in relation to the state and constitution of the patient. There have frequently been marked disorders of the secreting and excreting functions, and sometimes, also, a cachectic habit of body. In no instance have the previous health and existing state of the patient been such as to admit of venesection, or even of local depletions to a great amount. I have never prescribed the former for the complaint, and I have ordered the latter only in a moderate degree. The uterine or other lesions in which the disease often originates, the pre-existing state of the parts which are the seats of this disease, the antecedent and existing state of the patient, and the character of the pulse and other symp-

toms, not merely forbid the employment of general or large local blood-lettings, but warrant the adoption of restorative, and often even of tonic remedies. But the facts, *first*, that the disease generally originates in states of rapidly-induced anæmia, of vital exhaustion, or of vascular contamination; and, *secondly*, that both the morbid changes in which it originates, and the pathological conditions of which it consists, become more extended, and more rapidly contaminate the circulation, after vascular depletions and depressing agents, have been either altogether unknown to, or very remarkably overlooked by, the numerous writers on this complaint.

51. The chief *indications* are, therefore, *first*, to enable the powers of life to resist the extension of the changes constituting the malady, and, *secondly*, to palliate, reduce, and ultimately remove, the symptoms and lesions which already exist. These intentions should not be carried out altogether in succession, but in great measure simultaneously; and they are most appropriate in the cases of the disease occurring after parturition. My observation warrants me in stating that the most dangerous symptoms have occurred in those who had been most exhausted, or lost the largest quantities of blood either before or during the disease; while those cases proceeded most favourably for which the above indications were prescribed. I have certainly seen cases proceed favourably after the application of leeches in the course of the crural vessels; but I doubt any actual advantage having been derived from them. Dr. Churchill remarks that, "generally speaking, venesection will not be required; but if the patient be of a plethoric habit—if she have in some degree recovered her confinement, and if the disease set in with great violence, it may be advisable." (P. 426.) Now, without denying the occurrence of the complaint in these circumstances, it certainly takes place very rarely; but most commonly in opposite conditions of the patient. Dr. R. Lee states that, in all the cases he has witnessed, "there has been so much feebleness of pulse and prostration of strength," that he has not ventured to draw blood from the arm; yet he trusts for the relief of the inflammation "to the repeated application of leeches above and below Poupart's ligament;" and recommends "from two to three dozen of leeches to be applied immediately after the commencement of the disease, and the bleeding to be encouraged by warm fomentations." "Should the relief of the local pain not be complete, it is requisite soon to reapply the leeches in numbers proportioned to the severity of the attack, and to repeat them a third, or even a fourth, time at no very distant intervals, should the disease not yield." (*Cyclop. of Pract. Med.*, vol. iii., p. 349.)

52. Now I believe that "the feebleness of pulse and prostration of strength," so very justly insisted upon by Dr. R. Lee, as forbidding a recourse to venesection, equally forbid the application of leeches in the numbers, at least, here recommended by him. He considers the disease exclusively to consist of inflammation of the veins, and, according to his own showing, it should be treated as such. But I am confident that neither bleeding from the arm, nor applications of large numbers of leeches are beneficial either in phlebitis, or in lymphangeitis, or even in the association of both. I state this from a very sufficient experience; and I am supported in this by John Hunter, who has insisted upon the necessity of having recourse to such remedies as will prevent the extension of the disease along the vessels, and the contamination of the blood; neither of which objects can be accomplished by venesection, nor by the application of numbers of leeches. If, therefore, leeches be applied at all in the vicinity of the pain, or near the groin, they should be few.

53. I have shown, when treating of inflammations of the lymphatics, of the nerves, and of the veins, that blood-letting aggravates them, and that even moderate local depletions produce but little benefit; and, granting that inflammation of these vessels exists in phlegmasia dolens, and even that it originates in the pelvic viscera or parts, it is to be presumed, irrespective of the results of experience, that vascular depletions cannot be more serviceable in this malady than in the uncomplicated states of either of these inflammations. The very circumstance of the inflammation having commenced in some one of these viscera, especially in the uterus, and extended to the internal iliac veins, is a sufficient proof of the impropriety of having recourse to depletions of every kind; for, whether the complaint originates in the absorption of morbid matter from the uterus, or whether it arises in the lymphatics or veins themselves, extending along their internal surfaces, both the absorption and the disposition of the disease to extend itself will be very remarkably increased by depletions and other depressing agents. Indeed, I have no doubt of the extension of the disease to the opposite limb being caused chiefly by blood-letting and a lowering treatment. Instead, therefore, of approving the treatment usually mentioned in the works of writers upon midwifery and the diseases of women, I would advise that which my experience, since 1820, has shown to be most efficacious, not only in this disease, but also in several maladies occurring after parturition, as well as in others implicating the circulating vessels and fluids; and which, moreover, fulfils the intentions of cure above specified (§ 54, 55, *et seq.*).

54. Instead, moreover, of having recourse to the more decided antiphlogistic, or rather depressing, measures recommended by most of the English and French writers on the disease, I would advise the bowels to be moderately evacuated by means of a stomachic aperient (see Form., No. 266), or of castor oil and spirits of turpentine (from three to five drachms of each), taken on milk or some aromatic water; and of an enema containing these latter substances. The same remedies should be repeated, daily or occasionally, or as circumstances require; but I have not found it necessary to have recourse to them oftener than three or four times, although I have prescribed the enema more frequently. After evacuating the bowels by these means, a pill, containing from two to five grains of camphor, and one grain of opium, should be given, and repeated after three hours; and a third, or even a fourth, dose may be given after six or eight hours, according to the state of the patient. If there be irritability of

stomach, a grain of capsicum, or a drop of creasote, or both, may be added to each dose; and these will also diminish or prevent the headache usually complained of after taking opium.

55. Immediately upon first seeing the patient, and the more especially if pain is detected in the pelvic regions, either the warm *terebinthinate fomentation* should be applied, in the way so frequently advised in this work, over the hypogastric region and upper part of the affected thigh, or flannels moistened with this *embrocation* should be kept in the same situation as long as possible, covered with a warm napkin, and renewed from time to time, as circumstances may require.

No. 324. R. Linimenti Camphoræ co.: Linimenti Terebinthinæ, āā, ℥iss.; Olei Olivæ; Tinct. Opii, āā, ℥ss.; Olei Cajeputi, ℥jss. Misce bene, et fiat Embrocatio, more dicto utenda.

56. This treatment will often arrest the disease in a very short time, if it be resorted to at an early period; and, even at a more advanced stage, it will generally prevent the more dangerous symptoms, and the passage of the affection to the sound limb. If the disease be preceded or attended by an offensive discharge from the uterus or vagina, a frequent injection of a warm infusion of chamomile flowers and camphor water, with or without a drop or two of creasote, will be of service; and enemata containing spirits of turpentine, camphor, and asafœtida, may be thrown up occasionally. If the pulse be very frequent and weak, or continue in this state, after a recourse to the above means, the decoction of bark should be given, either with the hydrochloric, or nitro-hydrochloric acid, hydrochloric ether, and aromatic tinctures; or with the liquor ammoniæ acetatis, and full doses of the sesqui-carbonate of ammonia; or with the chlorate of potass and ether; and these remedies may be repeated as frequently as the case may require, and whether the swelling be abated or not, the camphor and opium being also taken as the severity of the pain and other symptoms may indicate.

57. If low fever, delirium, and other indications of extension of the disease to the common iliac veins, and of contamination of the blood be present, the decoction of bark, with the chlorate of potass and hydrochloric ether, or the alkaline carbonates and serpentaria; camphor, with aromatics and opium; the injections into the rectum and vagina above recommended; the cautious exhibition of wine, and even of brandy, with nutritious substances, as with arrow-root, the yolk of egg, &c.; and suitable articles of diet, are indispensable. It sometimes happens, as I observed in a severe case, in which both extremities were affected, that the very rapid subsidence of the swelling, and consequently the rapid conveyance of the matters which had been effused into the circulation by absorption, so contaminates the blood as to occasion the most dangerous as well as alarming symptoms; the patient labouring under low muttering delirium, with sopor or coma, and a very rapid, weak, or small pulse. In this case these symptoms did not appear until the swelling of both extremities had subsided with remarkable rapidity; they were treated as just recommended, and terminated favourably, without the least change existing in either of the limbs, shortly or long after the attack, as fully ascertained on several occasions.

58. The above treatment has been uniformly successful in the cases to which I have been called, although some of them have been very far advanced before I saw them. As I have never met with an instance of the malady that has been attended by sthenic inflammatory action, or that has occurred in a plethoric habit, or even moderately robust constitutions, but in opposite states of the system, so I have not had recourse to vascular depletions. If, however, the disease should occur in the former circumstances, vascular depletions may precede the means now advised, although I believe that they are not even in such cases so indispensable as many writers have supposed, and who have most erroneously believed that inflammatory affections are to be removed only by depletions, without duly considering that *inflammations* are various in character and diathesis, as I have shown in that article, and that they are often aggravated by a lowering treatment, and are then to be cured only by diametrically opposite means. It will be seen that I have recommended measures altogether consentaneous with my views as to the treatment of lymphangeitis, neuritis, and phlebitis, and in accordance with the sound principle laid down by John Hunter, but now so generally overlooked, namely, that in all spreading inflammations, and more especially in the inflammations of circulating vessels, the chief intention of cure should be to enable the constitutional powers to form coagulable lymph, whereby the disease may be limited, and the extension of the mischief and contamination of the system prevented; an intention to be fulfilled only by tonics and other restorative means.

59. Upon referring to the writings of the more recent writers, especially those upon midwifery, much difference of opinion as to the treatment of this disease presents itself. While Denman, Dewees, Blundell, Lee, Churchill, Raige-Delorme, Davis, and others advise vascular depletions, chiefly, however, by leeches, and only conditionally by venesection, a small minority, among whom Dr. Burns is most conspicuous, recommend tonic and restorative remedies. Dr. Burns remarks, that "at first we may use saline draughts; but these are not to be often repeated, and must not be given so as to produce much perspiration. In a short time they should be exchanged for bark, sulphuric acid, and opiates, which tend to diminish the irritability. In the last stage we may give a moderate quantity of wine. When the pain shifts like rheumatism, bark and small doses of calomel are useful. In every stage the bowels should be kept regular." (*Midwifery*, p. 612.) It is evident from this that Dr. Burns and myself adopt the same principle or indication of treatment, and that his remedies, as far as they are stated, are the same as those I have advised.

60. Much difference of opinion also exists as to the *local treatment* of the affection. I have already noticed (§ 55) what appears to me the most important part of that treatment. *Blisters* were recommended to be applied to the limb, immediately upon discovering the complaint, by Mr. Sankey, and were considered by him as a specific. He advises "the first to be ap-

plied to the calf of the leg, as the pain is generally most severe in that part, and there is less fear of its not healing than if applied lower. If required, he repeats the blister every two or three days, not at the same place, but higher or lower, according to the seat of the pain." (*Edin. Med. and Surg. Journ.*, vol. x., p. 402.) Some difference of opinion has been expressed respecting this practice. Dr. Dewees disapproves of it, and Dr. Churchill expresses himself favourably as to it. I have seen blisters employed only in one case, and I was led to believe them to have acted favourably, by procuring copious discharges of serum and of a sero-puriform matter, and thereby preventing or diminishing absorption and the extension of the disease along the vessels.

61. When the more acute symptoms have been subdued, and when the accompanying fever is either abated, or does not assume a severe or adynamic form, gentle support may be afforded to the limb by a slight flannel bandage drawn gradually tighter; and the *embrocation* prescribed above (§ 55) may be employed as a liniment, with gentle friction of the surface, if no abrasion of the cuticle have followed the application of it in the mode previously advised. As the disease subsides, a tonic, or at least a restorative, treatment is still generally required, with due attention to the state of the bowels; and a light nutritious diet—chiefly, however, of farinaceous articles. The best aperient in this state of the disease is that consisting of equal parts of the compound infusions of gentian and senna, with some neutral salt and an aromatic tincture (*sec Form.*, 266). If the swelling of the limb continue, the supertartrate of potash may be given with the bi-borate of soda, or the latter may be taken in any aromatic or tonic infusion in *small* doses, so as not to disorder the stomach.

62. As convalescence advances, change of air, warm salt-water bathing, and subsequently sea bathing, may be recommended. But in this, as well as in the early periods of ailment, due attention should be directed to the uterine functions and discharges; and the treatment ought to be varied accordingly, and after due examination of the state of the uterus. At an advanced period of convalescence the preparations of iron, especially the compound steel mixture (mist. ferri comp.), or the muriated tincture of iron, with the compound tincture of camphor, are generally most serviceable; but much of the management of the patient should depend upon the circumstance of each case, upon the contingencies which may arise, and upon the complications observed in the course of the complaint.

63. *The local states of disease, described above* (§ 35) *as either closely resembling, or being identical with, the affection now treated of*, should be viewed closely in connexion with those upon which they occasionally supervene. They can hardly be treated apart from the original maladies, and in some instances they will be but little benefited by any treatment whatever, especially when they occur in the course of malignant and consumptive diseases. In other circumstances, the treatment must depend upon the nature of their exciting causes and existing pathological conditions; the *indications* being to remove them, and to enable the system to oppose their progress, or entirely to overcome them; intentions which will be best fulfilled by the means already recommended.

[Dr. James Fountain, of Peekskill, N. Y., divides this disease into three distinct stages, each requiring widely different modes of treatment. These are, 1st. The *forming*, or *neuralgic stage*; 2d. The *albuminous*; and, 3d. The *serous stage*.

The neuralgic stage commences at the invasion of the disease, and continues till the violence of the pain has greatly subsided or nearly ceased, when the limb is at rest, and the swelling has reached its acme, or nearly so. This stage varies in duration, occupying from twelve to eighteen hours. The indication in this stage of the disease, according to Dr. F., is to tranquillize or allay nervous irritation at once, and thus arrest the disease by breaking up the first link in the chain of morbid catenation. This is to be accomplished by a full anodyne, as four to eight grains of opium, with as much gum camphor, and repeat the dose, if necessary, every two hours, till all pain ceases. Dr. F. states that he has prescribed this in six consecutive cases, and always with complete success. The anodyne has generally been prescribed at bedtime, in full dose, and the next morning every symptom has been found removed except a little stiffness. He accompanies the opiate with some warm vegetable infusion, which induces copious perspiration; and this is followed by a gentle laxative, with proper cautions against cold, to guard against a relapse. The second, or *albuminous* stage, is that in which the limb is swollen, of a pearly whiteness, uniformly smooth, tense, and elastic, very sore and painful when flexed, but not painful when at rest, nor pitting on pressure. When the swelling commences at the onset of the disease, Dr. F. states that it pits, because the effusion is serous; that it ceases to do so in a short time, because it has become too albuminous or jelly-like, and, in ordinary cases, continues so till the disease is changed. When, however, the affection continues to increase in intensity, by maltreatment or otherwise, coagulable lymph is poured out, or pus is formed; hence sometimes the limb remains permanently enlarged, or suppuration ensues. The indication in this stage is, to change the *albuminous into a serous state*, which is readily done by *emetics* alone. "No class of medicines," says Dr. F., "so soon and so effectually reduce nervous erethism, break up morbid associations, and consequent disordered movement of the capillary system, and set them right, as *emetics*. These considerations first induced me to resort to them in this stage of phlegmasia dolens, and I have uniformly found their operation to be decidedly and strikingly beneficial." Dr. F. prefers the *tart. antimony*, as being more decisive in its action on the nervous, and especially on the capillary systems. "Often one emetic alone," he observes, "will change the character of the tumefaction in twenty-four hours, freeing it from soreness, and causing the swelling to pit freely and deeply, being purely serous. When one emetic fails, a second may be given, or even a third, at intervals of twenty-four hours. I do not hesitate to say that three emetics at most, and very often one alone, will change any acutely

sensitive and swelled phlegmasia dolens into a passive serous state in as many days. Cathartics are of no avail in any stage of this disease, any more than to keep the bowels regular. In conjunction with emetics, the most advantageous local applications are, soothing fomentations of hops or poppy-heads, especially the latter, applied warm; over these a flannel should be placed, to retain the warmth and moisture. All kinds of stimulating liniments or embrocations are injurious, as is every degree of opiation, during this period. As soon as this course has succeeded in procuring a freedom from soreness, and a doughy, pitting feel, with coolness of the limb, the third, or serous stage, is fully established."

The *third*, or *serous* stage of the disease, which, according to Dr. F., consists almost entirely of a distention of the cellular tissue by a serous or watery fluid, except in those truly inflammatory cases which pour out fibrin, and are nearly incurable, is to be treated as one of uncomplicated anasarca. Our main dependance here is on the roller or bandage, extending from the toe to the hip. At first it is to be applied moderately firm, but drawn with more force daily. The bandage should be removed every twenty-four hours, and the whole limb rubbed with brandy, saturated with common salt, or with any stimulating liniment. Frictions with the hand or flesh-brush may now be resorted to with advantage, to give tone to the relaxed vessels. In this stage diuretics and tonics are indicated, as calomel and squills, some bitter alkaline infusion, and generous diet. Among other things, Dr. F. recommends especially an infusion of the *pyrola umbellata* and the *apocynum cannabinum*. Several successful cases are detailed, illustrative of the above pathology and treatment, which we would strongly recommend to the attention of medical men. See *New York Journal of Medicine and the Collat. Sciences*, vol. v., p. 151.]

Bibliog. and Refer.—*Mauriceau*, Malad. des Femmes Grosses, &c., t. i., p. 446.—*Puzos*, Traité des Accouchemens, &c., p. 350.—*Levret*, L'Art des Accouchemens, &c., p. 932.—*C. White*, An Inquiry into the Nature of that Swelling in one or both the Lower Extremities which sometimes happens to Lying-in Women, 8vo. Warrington, 1784.—*C. B. Frye*, An Essay on the Swelling of the Lower Extremities, &c., 8vo. Loud, 1792.—*J. Ferriar*, On an Affection of the Lymphatic Vessels hitherto misunderstood: in Medical Histories and Reflections, vol. iii., p. 112. Lond., 1798.—*J. Hull*, An Essay on Phlegmasia Dolens, 8vo. Manchester, 1800.—*T. Chevalier*, in Trans. of Med. and Chirurg. Society of London, vol. ii., 1811.—*Sankey*, in Edin. Med. and Surg. Journ., vol. x., p. 108.—*Wyer*, in ibid., vol. xv., p. 156.—*J. J. Westberg et Albers*, in Hufeland's Journ. der Prakt. Heilkunde, Feb., 1817, p. 3.—*J. L. Casper*, Commentaires de Phleg. Alba Dolente, 8vo. Halle, 1819.—*D. D. Davis*, An Essay on the Proximate Cause of the discalled Phlegmasia Dolens: in Trans. of Med. and Chirurg. Society, vol. xii., p. 419 Lond., 1823.—*W. Lawrence*, in ibid., vol. xvi., p. 58.—*Dugés*, Révue Médicale, t. iii., 1824.—*J. W. Francis*, in New-York Med. and Phys. Journ., No. i., 1824.—*D. Hosack*, Observations on Cruritis or Phlegmasia Dolens: in ibid., and in Med. and Chirurg. Review, vol. iii., p. 432.—*M. Ryan*, in London Med. and Surg. Journ., vol. iv., p. 325.—*J. Davies*, A Case of Phlegmasia Dolens, which terminated in Sphacelus of the Leg and Foot: in London Med. Repository, vol. xxiii., p. 451.—*A. Velpeau*, Recherches et Observat sur la Phlegmasia Alba Dolens: in Archives Générales de Médecine, t. vi., p. 220.—*Meissner*, in Siebold's Journ., &c., t. iv., p. 73.—*Fraser*, in ibid., t. vii., p. 647.—*Hermann*, in ibid., t. xi.—*Loewenhard*, in ibid., t. x., p. 352.—*Kruger*, in *Horn's* Archiv., t. iv., 1831.—*G. R. Treviranus*, in Annales Chir. Heidelberg, t. v., p. 492.—*J. L. Struve*, Comment. de Phlegmatia Alba Dolente, Observationes, xv. practicas continens, 8vo. Tubing., 1825.—*R. Lee*, A Contribution to the Pathology of Phleg. Dolens, in Trans. of Med. and Chirurg. Soc. of Lond., vol. xv., p. 132, 369, and Cyclop. of Pract. Medicine, vol. iii., p. 339, and Diseases of Women, &c., p. 117.—*J. Bouillaud*, Dict. de Med. et Chir. Pratiques, art. *Phleg. Alba Dolens*, t. xii.—*L. Pfeiffer*, Versuch über die Phlegmasia Alba Dolens, 8vo. Leips., 1837.—*Raige-Delorme*, in Dict. de Medecine, 2d edit., art. *Phleg. Alba Dolens*.—*F. Churchill*, Observations on the Diseases of Pregnancy and Childbed, 8vo. Dublin, 1840, p. 414. See, also, the Works on Midwifery and the Diseases of Women by *Denman*, *Burns*, *Capuron*, *Gardien*, *Davis*, *Dewees*, *Campbell*, *Blundell*, and others.

PHRENITIS. *See* Brain and its Membranes—Inflammation of.

PHTHISIS. *See* Tubercular Consumption.

PICA. *See* Appetite—Morbid States of.

PILES. *See* Hæmorrhoids.

PITYRIASIS.—Synon. Πιτυριασις, from πιτυρον, bran.—Πιτυρώδεις, *furfurosi*, *quibus assidue furfures in capite gignuntur*, Galen. *Alvarati*, Avicenna. *Porrigo*, Celsus, Lorry, J. Frank. *Tinea furfuracea*, Sennert. *Tinea porriginosa*, Astruc. *Furfurisca*, Gilbert. *Pityriasis*, Vogel, Willan, Bateman, &c. *Lepidosis pityriasis*, Young and Good. *Teigne, dartre, dartre furfuracée*, Fr. *Hautkleie, Schuppen, kleiengrind*, Ger. *Dandriff, Scurf.*

Classif.—II. Order, II. Genus (Willan). III. Class, I. Order (*Author*).

1. Defin.—*A chronic, non-contagious, superficial affection of the skin, attended by the production of minute white scales in great abundance, frequently on patches of irregular form, variable dimensions, and of a very light or dull red colour.*

2. I. Description.—*Pityriasis* may occur in any part of the cutaneous surface, sometimes on several parts in succession, and most frequently in certain parts in preference to others, but very rarely over the general surface. The patches are often attended by slight heat, pruritus, and tingling. The scales are thrown off soon after they are formed, and are reproduced with great rapidity. They are generally small and micaceous; in some situations, and in the more inflammatory states, they are large and lamellar; and in others, especially in the non-inflammatory, or at least when inflammatory action is least manifest, they are minute, pulverulent, or measly.

3. The Varieties of Pityriasis, according to Willan, are the *rubra*, *visicolor*, and *nigra*. But Rayer and Wilson divide the complaint into *general* and *local*, subdividing the latter according to its situations, and consider the varieties *versicolor* and *nigra* of Willan as not properly belonging to this affection, but to those affections which consist chiefly of alterations of colour. *Pityriasis*, however, may be *simple* or non-inflammatory, and *associated* or consequent upon an erythematous or superficial inflammation of the skin. I shall, therefore, view it in these phases, the former of which has been overlooked by the writers just named; retaining, also, the varieties rejected by Rayer. As the local forms of this eruption are the most commonly observed, I shall consider them before I notice the more general affection, the occurrence of which is comparatively rare.

4. i. Local Pityriasis.—This complaint, according to the situation and grade of the inflammatory action attending it, has been variously denominated and described by writers since the days of Galen and Celsus down to those of Willan and J. Frank. Hence different meanings have been attached to the term pityriasis, and have occasioned no small amount of confusion. The more precise descriptions of Caze-

nave, Wilson, Raver, and others have, in great measure, removed this evil; but there still remain a few omissions to supply and imperfections to remove, even in the accounts which they have furnished. *Local pityriasis* may be non-inflammatory or *simple*, and inflammatory or *complicated;* and in either form it may present, in some cases, shades of colour different from those usually observed, even independently of any decided evidence of inflammatory action in the part—facts not sufficiently adverted to by some writers on the complaint. The *varieties* which I shall notice are the following: *Pityriasis capitis, simplex et associata; P. palpebrarum; P. labiorum et oris; P. palmaris et plantaris; P. præputialis et pudendalis; P. versicolor; P. nigra.*

5. *A. Pityriasis capitis* has been too generally viewed as an inflammatory affection, and described as such. That it most frequently possesses this character, especially in adults, cannot he disputed; but it is occasionally, even in this class of patients, devoid of every inflammatory appearance.—*a. Pityriasis capitis simplex* is frequent in infants and old people, and rarely observed in the middle-aged and young. Its presence is indicated by innumerable minute white scales, which are rapidly produced and thrown off. They are thin, white, and dry, and at first adherent at one side and free at the others, but are very readily detached. Upon removing them the surface presents no inflammatory sign, but, on the contrary, has a dull, indolent appearance, and is without any visible capillary vessels. The exfoliation and reproduction of the cuticle proceed with various degrees of rapidity, and furnish, accordingly, quantities of these scales, which collect near the roots of the hair, and fall out upon scratching the part, or combing the hair. This form of the complaint is not attended by any, or but a slight, itching, which is chiefly owing to the presence of the accumulated scurf. It is observed chiefly in those of a dark complexion, or with black or dark-brown hair, and of a delicate constitution, or disposed to disorder of the digestive organs.

6. *b. Pityriasis capitis rubra* or *complicata* is most common, especially in the young and middle-aged. Its occurrence is indicated by a number of minute scales, appearing in some part of the scalp; usually of a white, whitish gray, or yellowish gray colour; very thin, especially at their edges, and perfectly dry. They are often imbricated in children, but in old persons they are scattered irregularly. Their formation is often so rapid that, although they may be all detached by the comb, they will collect in nearly equal quantity in a day or two. When they thus accumulate the patient cannot scratch his head, or even arrange his hair, without detaching numbers, which fall upon his clothes in the form of a white mealy powder. When the scales are small, they are generally of a pure silvery white; but when they are larger they assume a duller, or even a darker hue. Upon separating the hairs and removing the scales the scalp is found to be dry, rough, reddened, and shining in spots or patches. In very chronic cases the surface is often of an opaque, grayish white; the cuticle appears to be thicker and coarser than natural. The scales are generally larger and thicker in this variety than in the former, and sometimes they attain a diameter of five or six lines. They occasionally form by their union a thin layer, especially in children, extending over a considerable portion of the scalp, being thickest at points where they are most abundantly evolved.

7. The most frequent seat of pityriasis is the scalp; and when partial, or in patches, it is most commonly seen about the coronal and squamous sutures, whence it may extend to the temples, forehead, and to the eyebrows. The itching attending the eruption is often annoying, causing the patient to scratch the part and to loosen showers of scurf. When the affection is of long standing, and is attended by much superficial inflammation, or where it is much irritated by scratching, it is often followed by the evolution of eczematous vesicles, and eczema auriantacea is developed from the admixture of the scales of pityriasis with the eczematous discharge.

8. This complaint may continue for many months, or even for many years, especially in the aged, and may appear, also, in various parts of the face and body. When it is approaching a favourable termination, the scales are not formed so rapidly, and at last they cease to be produced; the skin, however, remains for some time of a light or dull red, or yellowish red, and slightly shining. But it often appears in a different part, or extends or is aggravated after errors in diet, especially after overloading the stomach, or after taking spirituous liquors or fish, more especially shell-fish; and it may thus ultimately abate and be exasperated for a long and indefinite time.

9. *B. Pityriasis palpebrarum* may exist alone; but it most frequently commences in the eyebrows, or is an extension of the eruption in the scalp. It is apt to occasion the loss of some of the eyelashes, and to give rise to chronic irritation or inflammation of the conjunctiva. It is to be distinguished from psoriasis in this situation by the smallness and thinness of the scales, and the erythematous appearance of the patches when the scales are removed.

10. *C. Pityriasis labiorum et oris* differs in nothing from the red variety of the complaint, excepting the situation. When affecting the lips, it is apt to be confounded with psoriasis; but it differs from this latter in appearing as red stains, and not as papular elevations, followed by thick squamæ. To the red stains succeed a general redness and continual desquamation of the epithelium of the lips, and occasionally of the cuticle of the adjoining skin. Desquamation of their transparent laminæ, resembling the dried healthy epidermis, proceeds along the lips, the laminæ becoming detached first at the edges, and adhering longest in the centres. The lips are tender, heated, and tumid; the epithelium is yellow and thickened, and then cracks and is detached as just stated, a new epithelium being formed under that which is about to fall off. This new cuticle in its turn becomes yellowish and cracked, and ultimately is detached, and thus the affection is perpetuated. It is different from the slighter and more transient affection much resembling it for a short time, that follows exposure to cold and various acute diseases, and is a most obstinate complaint, at one time nearly disappearing and again return-

ing even in a worse form than before, and with considerable swelling of the lips. M. Rayer remarks, that he met with this variety in two great talkers who were frequently biting their lips. The epidermis of the external surface in the immediate vicinity often undergoes a similar redness and desquamation, although the affection is sometimes limited to the epithelium.

11. An affection of the *internal surface of the mouth*, closely resembling that of the lips, has been described by M. Rayer, and a few instances of it have been seen by myself. It consists chiefly of redness, tenderness, heat, and protracted desquamation of the epithelium of portions of the surface of the tongue and gums, and the internal surface of the cheeks, and in rare cases of the whole surface of these parts. In all the cases I have seen there has been more or less serious chronic disorder of the digestive organs.

12. *C. Pityriasis præputialis* and *P. pudendarum*. The *prepuce* of the male and the *labia majora* of the female are sometimes the seats of a superficial chronic inflammation, giving rise to exfoliations of the epithelium, and to an increased secretion of the follicular fluids of these parts, especially in persons who are subjects of pityriasis capitis; and occasionally even the external surfaces of the parts now named are also similarly affected; generally, however, to a limited extent. These affections are usually ameliorated or aggravated by the states of the digestive organs; and sometimes they entirely disappear for a time, and again return. They are always obstinate.

13. *D. Pityriasis palmaris* and *P. plantaris* are varieties which were confounded with psoriasis affecting the palms and soles, until distinguished from it by M. Rayer. This eruption commences in these situations as small red spots or stains of irregular outline, which spread and soon acquire a yellowish hue. The epidermis thickens, dries, and cracks, and is constantly peeling off in foliaceous lamellæ, the exfoliation sometimes extending to the fingers and nails. Attention to this state of the eruption at the commencement will readily determine its nature; for psoriasis begins with papular elevations, the summits of which are soon afterward covered with dry, thick squamæ of a dull whitish colour. Pityriasis of the palms or soles is attended by painful tingling and tenderness, and increased heat, which become so much increased when the patient is warm in bed as often to break his repose.

14. *E. Pityriasis versicolor* appears in the form of continuous patches of various size, covered by a furfuraceous desquamation. It is characterized by a varied yellowish or yellowish-brown discoloration of the cuticle, which even continues for some time after the cure of the complaint. It occurs chiefly on the neck, chest, shoulders, and abdomen, and rarely on the face. It is distinguished from the ephelides by the furfuraceous desquamation, and from other cutaneous affections by the peculiar pale yellow or yellowish-brown hue of the cuticle. It is as obstinate to remove as the other varieties already mentioned. In the instances of brownish discoloration, the scurfiness of the surface is often but slight; the discoloration being more deeply seated than the cuticle, and evidently existing in the rete mucosum, as remarked by Willan. In some cases, however, the discoloured cuticle is exfoliated, leaving the new cuticle of a red hue, as in the more common states of the affection. Mr. Plumbe mentions instances in which no sensible elevation was perceptible to the finger when passed over the discoloration, although a dry cloth forcibly rubbed over it detached films of delicate cuticle, leaving the surface underneath tender and inflamed.

15. *F. Pityriasis nigra* is of rare occurrence. Dr. Bateman describes it as commencing in a partially papulated state of the skin, and terminating in a black discoloration, with slight furfuraceous exfoliations. It appeared chiefly in the extremities, and in the fingers and toes. MM. Cazenave and Schedel state that numerous instances of this variety were observed in Paris in 1828 and 1829. The furfuraceous desquamation appeared on a deep black surface. The affection occurred in two distinct forms. In the one the epidermis was the seat of discoloration, and, if detached, a red surface appeared beneath. In the other the epidermis was transparent, and the cutis vera was the part discoloured. Dr. A. T. Thomson remarks, that the affection which prevails in Mexico, termed the *pinta*, or *blue stain*, appears to be a variety of pityriasis nigra. "It commences with slight febrile symptoms, which last a few days only, and, on subsiding, leave the face, breast, and limbs covered with yellowish areolæ, which change to a blue, and, in advanced stages, to a black colour. The skin assumes a rough and scaly appearance, and exhales an offensive perspiration." (*Bateman's Synop. of Cut. Dis. by* A. T. Thomson, p. 77.)

16. ii. General Pityriasis.—*a*. This is a rare state of the complaint, and is much more rarely met with in a *simple* or *non-inflammatory form*. Yet I have seen a very few instances in persons of a dark complexion, with the limbs much covered with hair, of a furfuraceous exfoliation of the cuticle, proceeding with remarkable rapidity, and followed by as quick a removal of it in several parts of the body, but especially on the outsides of the thighs and near the joints, appearing in one part as it subsides in another, without any apparent redness of the surface either before or after the exfoliations. The scurf which is detached consists of very minute silvery white scales, which the slightest friction detaches in great numbers. These evidently proceed from exfoliation and rapid production of the epidermoid scales, either independently of inflammatory action or in consequence of so slight a grade of it as hardly to be observed; and depend more upon the production and nutrition of the epidermis than upon increased vascular action. In the very few instances I have seen, the scalp, lower parts of the face, arms, and lower extremities were chiefly affected.

17. *b*. The *inflammatory state* of general pityriasis is oftener seen than the foregoing, although very much less frequently than the local varieties. It is a most obstinate affection, and is generally complicated with disorder of one or more of the abdominal viscera. The eruption is preceded by itching, tingling, or pricking in the surface about to be its seat. When closely examined, superficial erythematous spots or patches may be detected. The heat of the

surface is increased, and the part is slightly tumid. The inflammatory blush diminishes, and even shortly afterward entirely disappears within a few days, so that this variety of the affection, if not seen early, may be mistaken for the non-inflammatory form. The epidermis then cracks, becomes less adherent, and desquamation commences. The scales thrown off vary in their appearances with the seat of the eruption, and the grade and duration of the inflammation. On the insides of the limbs they are usually small, micaceous, and pulverulent. On the outer surfaces of the extremities they are much larger, and often vary from three to six or seven lines in diameter. They consist of foliaceous lamellæ, which continue to adhere by their centres or extremities for a considerable time after they are partially detached; and thus they appear as loosely floating on the surface. When removed, especially by friction, the parts affected are of a rose colour, and slightly tumid. When the accompanying pruritus impels the patient to scratch the part, the surface exudes a yellowish serous fluid, similar to that observed in moist eczema; and when this takes place to a considerable extent, the diagnosis is thereby rendered obscure. Behind the ears, about the axillæ, bends of the arms, groins, wrists, and insteps, the inflamed surface assumes much of the appearance of intertrigo—is rough, moist, and chapped in the direction of the natural folds of the skin. On the breast and abdomen the desquamation occurs in much larger lamellæ than on the back. On the olecranon and patellæ, and especially on the palms and soles, where the cuticle is much thicker than on other parts, exfoliation takes place in larger and thicker laminæ than elsewhere. On the face and scalp the scales are much more minute and powdery.

18. Pityriasis, particularly the more general states of it, is attended by much pruritus; but this sensation is most annoying when the eruption is recent and the inflammation considerable; and the enjoyment, if not the relief, experienced from scratching is the greatest; but it is generally followed, when indulged in, by painful smarting, so as to disturb the rest. It is very rare that the more general states of the eruption are seen without the scalp being affected also. In all cases where this part is implicated, the *hair* is not affected or changed for a considerable time, or until the disease has continued long. It then gradually changes to gray, and becomes finer, softer, and weaker; ultimately it gradually falls out; but baldness is rarely the result, unless in aged persons, although it is generally thinner in protracted cases.

19. *c.* The *course* of general pityriasis varies in individual cases. It often appears in one place as it subsides or disappears from another, and is always a most protracted complaint. The scales become small and pulverulent when it is subsiding or is still lingering, and large and foliaceous when it is recent or has been irritated, and the inflammation considerable. The surface is red and moist in this latter case, and pale white, or slightly yellowish, in the former. When the eruption is most acute, or is exasperated, especially on the lower extremities, and in these even when the redness under the scales is hardly perceptible, tumefaction of the affected parts is very common, owing more, probably, to the thickening consequent upon the irritation than to the state of the subjacent cellular tissue. The hair covering the limbs is much more readily lost during the eruption than that of the scalp.

20. *d. Associations.*—I have rarely, or perhaps never, met with an instance of this eruption, whether *local* or *general*, without being *associated* with disorder of the digestive functions. In most instances there is chronic dyspepsia, often with torpor of the liver, and sometimes with indications of chronic inflammation of the mucous surface of the stomach or bowels, or of both. Flatulence is often, also, complained of; and in females, dysmenorrhœa, in some amenorrhœa, is not infrequently, also, associated with it. Fever seldom attends the local or partial states of the eruption, but it sometimes appears during the more general and severe forms, or when exasperated by external irritation or a stimulating diet.

21. II. Diagnosis.—The scurf seen on the foreheads of very young infants, and that on the scalp of aged persons, are not always exfoliations of the epidermis, but rather the incrustations consequent upon the state of the cutaneous secretion and neglect of cleanliness. Very slight attention, however, will enable the physician to distinguish these cases. M. Rayer remarks, "that the scalp and extremities of some adults, and especially aged persons, are occasionally affected with an habitual exfoliation of the epidermis, which differs essentially from pityriasis by being attended by neither redness, heat, nor any other morbid sensation." Now this is the condition which I have denominated *simple*, or *non-inflammatory*, pityriasis, and stated to consist of a morbid or excessive exfoliation of the epidermis. It is often attended by slight itching, and slight friction will readily induce an inflammatory blush of the surface, indicating increased irritability of the vessels of the rete mucosum, and generally, also, by disorder of the digestive organs.

22. The exfoliation of the cuticle in pityriasis differs from that which takes place in all the varieties of *psoriasis*. For in this latter eruption the cuticle is thickened, rough, dry, and of a dull white colour; and the red patches always rise above the level of the surface, while those of pityriasis are not at all prominent. In psoriasis, also, the inflamed surface, even when deprived of the squamæ, remains dry, while that of pityriasis exudes a serous fluid. In the former the integuments are not swollen and painful, excepting in *psoriasis inveterata*, and in it only to a limited extent; while in the more acute or inflammatory states of the latter they are often painful and swollen over a large extent of surface. The heat and pruritus in pityriasis, also, are much more troublesome than in psoriasis. The same circumstances also distinguish pityriasis from the *leprous form* of psoriasis, with this distinction in addition, that the leprous variety generally assumes a circular form, and heals from the centre to the circumference. The detachment of the cuticle in *ichthyosis* is not preceded by redness or morbid sensation of the skin, and the desquamation following chronic *lichen* and *eczema* is preceded by papulæ and vesicles.

23. III. Prognosis.—Pityriasis is one of the

most obstinate affections of the skin, more especially the more general forms of it. Even the local varieties are difficult to remove, and often return again and again, especially after errors in diet, and during disorder of the digestive organs. Of these latter varieties, that affecting the lips and mouth is the most rebellious. The duration and extent of the affection, and the association of it with internal disorder, as well as the nature of that disorder, should all be duly considered before an opinion as to the probable effect of treatment is given, and before the means of cure adopted. In all severe and complicated cases, more especially where the eruption is more or less general, and the digestive and respiratory mucous surfaces affected, the removal of the complaint is a work of time, and is not to be accomplished without effecting a change in the constitution by diet and regimen.

24. IV. Causes and Complications.—The causes of this eruption are often obscure, and are more rarely local than constitutional, or such as affect the digestive organs, and through them the state of the constitution. Local irritants, the use of combs, or hard hair-brushes, the kind of soap used, and the operation of shaving, have been usually considered as exciting causes; but I believe that they are much less concerned in producing this affection than the following, namely, too full or rich living; improper or unwholesome diet; the frequent use of pork, bacon, and dried, smoked, or preserved meats, or of shell-fish; prolonged and repeated irritation of the gastro-intestinal surface, by these or by other articles of an indigestible kind; drinking cold fluids when perspiring; a morbid condition of the gastro-intestinal secretions; torpor of the liver, and a disordered state of the biliary and pancreatic secretions; exhausting discharges, and anxiety and exertion of mind. There can be no doubt of either or several of these causes being the most efficient in causing a return of this eruption in those who have been before attacked, and in aggravating all the symptoms in those who are already affected. The more general forms of the eruption are often associated with dyspepsia, flatulence, and chronic inflammatory action of either the pulmonary or the gastro-intestinal mucous surface, or even of both.

25. V. Treatment.—*A.* The *local varieties* of pityriasis generally require the utmost attention to cleanliness, and soothing and emollient applications.—*a.* When the *hairy scalp* is affected with the more severe forms of this eruption, the hair should be cut as short as possible, and the dried exudations and squamæ softened by means of poultices and the vapour douche, the latter of which should be continued for some time, and alternated with alkaline or emollient lotions. If there be much redness and heat of the surface with serous exudation, leeches ought to be applied behind the ears, and the calomel ointment (one drachm of calomel to one ounce of ointment) rubbed over the inflamed surface once in the twenty-four hours, after carefully washing the surface with an emollient soap, such as camphor or palm-oil soap. At the same time the bowels should be freely evacuated, the abdominal secretions and excretions duly promoted, and the cutaneous exhalations increased by means of purgatives, alteratives, and cooling diaphoretics.

26. Due attention ought also to be paid to *diet*. The stomach ought never to be overloaded, and the quantity of animal food should be very much diminished, if it be partaken of largely, or even more than very moderately. Pork, bacon, veal, fish, particularly shell-fish; dried and smoked meats, and all other articles of food which are apt to occasion or to aggravate indigestion and gastro-intestinal irritation, ought to be avoided, and farinaceous articles of food and fresh vegetables substituted for the meat dishes which are relinquished, avoiding, however, all pickled, acid, acerb, and acrid articles whatever.

27. *b.* These means will generally remove the more recent cases of the eruption; but the more *chronic states* are often but partially relieved by them. I have considered that this and other cutaneous eruptions, which are attended by the exposure of a considerable portion of the inflamed surface to the action of the atmosphere, especially of the oxygenous portion of it, are aggravated by whatever tends to increase that exposure, either by removing the exudation and scales formed upon this surface, or by preventing their formation, and the protection they afford until a healthy epidermis is formed beneath them; and, therefore, instead of advising various deterging lotions, usually recommended, I have directed the surface to be covered, when the accumulated scurf and scales have been removed, with some albuminous or gummy application which may completely exclude the air from the affected part. The albuminous portion of egg, the solution of isinglass, or of gum acacia, or of tragacanth, will answer this purpose sufficiently.

28. *c.* In those cases which are attended with flatulence, acidity, and a predominance of the uric acid or urates in the urine, and, indeed, in most of the forms of this complaint, a sufficient quantity of magnesia and precipitated sulphur may be taken every night to procure a free evacuation of the bowels in the morning, and be continued for a considerable time, observing due precautions as to diet and regimen, and attending to cleanliness. The variety of pityriasis capitis which attacks adults, and especially the aged, and is attended with little or no inflammatory action, requires chiefly attention to cleanliness, diet, and regimen, and the removal of those symptoms of indigestion and gastro-intestinal irritation which are so frequently observed to attend this eruption. In these cases, the alkaline carbonates, taken in gently tonic infusions; the nitrate of potash, or the hydrochlorate of ammonia, in small doses, with emollients and vegetable bitters; or these with the hydrocyanic acid, will often be of service. The bowels should also be regulated by means of magnesia and sulphur, as just advised. In these cases, dyspepsia and gastro-intestinal irritation are generally associated with debility; and we shall in vain endeavour to remove the former if we neglect the latter, or to remove the eruption if we overlook these complications.

29. *d.* Mr. E. Wilson advises, after the inflammatory action is removed, some weakly-stimulating application to the surface, such as alkaline lotion, consisting of a drachm of liquor

potassæ to half a pint of emulsion of bitter almonds, or camphor spirit, or a weak solution of the bichlorate of mercury. A solution of two or three grains of bichloride of mercury, in half a pint of emulsion of bitter almonds, he considers best suited for patches on the face; and the zinc ointment for pityriasis palpebrarum, præputialis, and pudendalis. The vapour bath or douche, with the white precipitate ointment, are recommended by Rayer for pityriasis, palmaris, and plantaris. In these varieties, I believe that the recently-prepared calomel ointment, and due protection of the surface affected in the way just advised (§ 27), will be found preferable to the means directed by these writers.

30. *B. The more general states of pityriasis* are very frequently complicated with an inflammatory or congested state of the digestive or respiratory mucous surfaces, or with disorder of the abdominal organs; and hence the necessity of having a strict reference to these associations of disorder during the treatment.—*a.* If the patient be young, robust, or plethoric, venesection to a moderate amount, and even the repetition of it, will be necessary, especially in recent and acute cases. Sometimes these complications appear not until the pityriasis has been of some duration; but in these bloodletting may not the less be required. Still, the circumstances of the case ought to be taken into account; for this form of the eruption occasionally appears in persons exhausted by mental exertion and anxiety; and for these relaxation and a complete change of habits and modes of living are required. Temperate mucilaginous baths, due regulation of the bowels, cooling diaphoretics, especially the liquor ammoniæ acetatis, spiritus ætheris nitrici, potassæ nitras, or the ammoniæ hydrochloras, taken in emollients or demulcents; the nitro-hydrochloric acids, taken internally, or applied externally, and a farinaceous, demulcent, and vegetable diet, are the means which deserve the greatest confidence.

31. *b.* If the bowels require assistance, the repeated use of the magnesia and sulphur, as above advised (§ 28), will be found most serviceable in this and in other forms of the eruption. If they become relaxed, ipecacuanha with any of the preparations of opium, or with the tinctura camphoræ composita, and a frequent recourse to mucilaginous baths, and to applications of albumen, or of solutions of gum, &c., over the more inflamed and denuded surfaces, will prove most beneficial. In this as well as in most other forms of the eruption, the preparations of *arsenic*, or even of *iodine*, are not so serviceable as in some other scaly affections, particularly when dyspeptic symptoms or gastro-intestinal disorders are present. But cases occasionally occur in which they are very advantageously taken immediately after a meal; and when thus administered they will not induce or aggravate these symptoms.

32. Mr. Wilson remarks that the local affection "is to be treated by emollient baths, fomentations, alkaline baths, and opium to lull the pruritus." Dr. A. T. Thomson advises a lotion, consisting of one drachm of the solution of potash; one drachm of the dilute hydrocyanic acid, and seven ounces of the mixture of bitter almonds to be applied to the affected surface, in order to quell the pruritus. I cannot quite approve of these means of cure, for the reasons already assigned (§ 27), especially of the more detergent substances employed, and am not surprised at their frequent failure. The treatment recommended by Bateman will be found more successful than that now noticed, namely, a combination of antimonials with decoction of woods, and warm baths. And when the irritability of the skin is not very great the application to the parts of an astringent lotion containing alum, or the di-acetate of lead, or a lotion containing borax. Emollient lotions and baths, containing also the sulphuret of potassium, are often useful. Mr. Erichsen advises them to be aided by an ointment of white precipitate of calamine, or of the oxide of zinc.

33. *c.* The *Harrowgate* and other *sulphureous waters* are often of use in all the varieties of pityriasis. In a remarkably severe case of the general form of the eruptions in a married lady, about the period of the cessation of the menses, which was under my care, a prolonged course of these waters, following an active course of medicine, effected a complete and permanent cure. The discoloured varieties of the eruption, described by Willan and Bateman, and but rarely met with, require the same treatment as that advised above.

34. In most instances, especially the more chronic and general states of this eruption, comparatively little benefit will accrue from any method of cure, if the state of the digestive organs, and the diet and regimen of the patient, be neglected. For in this, as well as in all other chronic diseases of the skin, a complete and enduring cure can be obtained only by a change in the constitution, brought about by a suitable diet and regimen, and habits of life. What the diet, regimen, and habits ought to be cannot be stated with precision, as they should be partially accommodated to the circumstances of individual cases; but, in general, those in which the patient has indulged before and during the commencement of the affection require change. Abstemious and regular habits should be adopted, avoiding rich, indigestible, and heating articles of food, and stimulating beverages, and substituting farinaceous and vegetable substances, as far as may be prudent. Mental exertion and anxiety should also be avoided as much as possible; exercise in the open air ought to be regularly enjoyed; and sexual indulgences restrained within due bounds.*

Bibliog. and Refer.—*Galen*, De Composit. Medicament. secundum Locum, lib. i.—*Celsus*, lib. vi., 2.—*Oribasius*, Synopsis, lib. vi., cap. 25.—*Aetius*, lib. vi., cap. 66.—*Alexander Tral.*, lib. i., cap. 5.—*Paulus Ægineta*, lib. iii., cap. 3.—*Avicenna*, lib. iv., Fen. vii., tr. 2, cap. 24.—*Foresters*, lib. viii., Observ., 12, 13.—*Mercuriali*, De Morbis

* I have at present under my care a case of general pityriasis in a man, of great extent and severity. He has tried courses of the solution of the iodide of mercury and arsenic, of the sulphur and vapour baths, and the Harrowgate and Leamington waters, without benefit. He is about fifty years of age, has lost an arm, is of a full habit of body, and has lived freely. A severe diet, chiefly of farinaceous and vegetable food, sponging the surface with cooling lotions, exercise in the open air, and a course of alterative medicines were prescribed for him, but as yet the benefit derived is only partial, the restricted diet and prescribed regimen not having been observed. The great difficulty in the treatment of this and other diseases of the skin, is to convince patients of the necessity of observing a strict regimen, or rather to secure their faithful and continued adoption of the diet and regimen prescribed.

Cutis, cap. vii.—*Sumertus*, Pract. Med., &c., lib. v., pars iii., sect. i., cap. 7.—*Alibert*, Précis Théurique et Pratique sur les Malad. de la Peau, 2 tomes, Paris, 1822, plate 11.—*Willan*, On Cutaneous Diseases, 4to, 1805.—*Bidoux*, Réflexions pratiques sur les Maladies de la Peau, 8vo. Paris, 1826.—*T. Bateman*, Pract. Synopsis of Cutaneous Diseases. Edit. by *A. T. Thomson*, 8vo. Lond., 1829, p. 71.—*M. Good*, The Study of Medicine, 4th edit., 8vo. Lond., 1834, vol. iv., p. 443.—*Plumbe*, Pract. Treatise on Dis. of the Skin, 2d edit., p. 202.—*P. Rayer*, Theor. and Pract. Treatise on Diseases of the Skin. Transl. by *R. Willis*, 8vo. Lond., 1835, p. 654.—*W. C. Dendy*, Pract. Remarks on Diseases of the Skin, 8vo. Lond., 1837.—*J. Green*, Pract. Compendium of the Dis. of the Skin, with Cases, 8vo. Lond., 1835, p. 233.—*J. E. Erichsen*, Pract. Treatise on the Dis. of the Scalp, 8vo. Lond., 1842, p. 164.—*E. Wilson*, Pract. and Theor. Treatise on the Diagnosis, Pathology, and Treatment of Dis. of the Skin, &c., 8vo. Lond., 1842, p. 231.—*Cazenave* and *Schedel*, Manual of Dis. of the Skin. Transl. by *T. H. Burgess*, 8vo. Lond., 1842, p. 217.—See, also, the Illustrations of Willan, Rayer, and Willis, &c. Medical literature furnishes little either truly satisfactory or practically useful respecting the pathology, the constitutional relations, the complications, and the treatment of this obstinate and generally symptomatic eruption.

PLAGUE. See Pestilence, Septic or Glandular.

PLETHORA. See Blood, Exuberance of.

PLEURA, Diseases of.—Synon. Πλευρὰ vel πλευρον, pleura, the membrane covering the internal surface of the ribs, according to the ancient meaning; now the membrane covering the internal parietes of the thorax, and reflected over both lungs.—*Pleure*, Fr. *Brustfell*, *rippenfell*, Germ.

1. I shall consider at this place those diseases which commence and are seated chiefly in this membrane; but the consecutive changes to which the pleura is liable will also receive due attention. *Inflammations of the pleura* will be first discussed, and next the *other organic lesions*, which either commence in, or consecutively implicate this membrane, will be treated of, occasional reference being made to associated affections and diseases of the lungs (*see that article*) and of other connected and adjoining organs.

Inflammation of the Pleura.—Synon. *Pleuritis*, *πλευρῖτις*, *πλευρῖτις νοσος*, morbus lateralis, the side disease. *Morbus pleuriticus*, Celsus. *Passio pleuritica*, *Morbus costalis*, *Pleurosis*, Auct. Var. *Febris Pleuritica*, Hoffmann. *Pleuritis Pulmonis*, *Pleuroperipneumonia*, Auct. *Pleuritis*, Vogel, Sagar, Boerhaave, &c. *Pneumonia pleuritis*, Cullen. *Cauma pleuritis*, Young. *Empresma pleuritis*, Good. *Inflammatio pleuræ*; *Pleurisie*, French. *Brustfellentzündung*, *Seitenstich*, Germ. *Pleurite*, *plurisia*, Ital. *Plurisy*.

Classif.—I. *Class*, 2*d Order* (Cullen). II. *Class*, 3*d Order* (Good). III. Class, I. Order (*Author in Preface*).

2. Defin.—i. Nosolog.—*Acute pain in the chest, aggravated by inspiration, commencing with chills or rigours, followed by increased heat, a hard and accelerated pulse; short, dry cough; and by difficult, short, or disordered respiration.*

ii. Patholog. Defin.—*Inflammation, commencing in or implicating one or more parts of the pleural expansions, attended either by more or less of a consistent albuminous exudation, false membrane or adhesion, and by a fluid effusion, varying in their characters with the varying states of different cases; causing pain, symptomatic fever, disordered respiration, dulness on percussion, and alteration of the respiratory sounds.*

3. *Pleurisy* has been mentioned by Hippocrates and Celsus in several places, and more distinctly by Galen; but Aretæus was the first to describe it with precision, and with reference to the treatment. Cœlius Aurelianus, Alexander Trallianus, and Paulus Ægineta have also treated of it at considerable length. All these writers have viewed the disease as seated in the pleura lining the ribs, or external parietes of the chest. Modern physicians, who agreed with ancients in limiting the malady to the pleura, did not also agree with them in believing that it was confined to this portion of the pleural surface, but that it was seated, with, probably, much greater frequency, in the pleura reflected over the lungs and other parts. While Boerhaave, his commentator Van Swieten, and others contended for the separate and distinct affection of the pleura, Sydenham, Hoffmann, Triller, and Morgagni believed that the pleura and the substance of the lungs were generally both implicated, and that the one could rarely or never be inflamed without the other being also attacked. Hence *pleuropneumonia*, or pleuro-pneumony, was used to designate inflammation of these distinct structures. This latter view was followed by Cullen, Portal, the Franks, and many others. Nevertheless, it is now fully demonstrated by *post-mortem* examinations, as well as by the physical and rational symptoms during life, that inflammation may commence in, and be limited to, the pleura in some cases, and may be equally confined to the substance of the lungs in others; although in perhaps a still more numerous class of cases, it may originate in the one and extend to the other, implicating either of them more or less, as I have fully shown when treating of *inflammations of the lungs* (*see art.* Lungs, § 73–75), and as the researches of Laennec, Andral, Louis, Cruveilhier, Williams, Forbes, Chomel, and Stokes also have fully demonstrated.

4. It has been fully shown by Dr. Stokes that the superficial description of many anatomical writers has given rise to incorrect views as to the connexion between the pleura and the parts over which the pleura is reflected. Instead of this membrane being connected to these parts simply by means of a subjacent cellular tissue, it has interposed, between it and these parts, a thin but dense fibrous membrane, which entirely envelopes the lungs, and forms a strong capsule for these organs. Dr. Stokes remarks, that this capsule, in the healthy state, though possessing great strength, *is transparent*, a circumstance in which it differs from the fibrous capsule of the pericardium, and which has probably caused its being heretofore overlooked; and that it is always more perceptible in disease implicating the pleura and subjacent tissues when they are more or less hypertrophied and rendered opaque. "This fibrous tunic invests the whole of both lungs, covers a portion of the great vessels, and the pericardium seems to be but its continuation, endowed in that particular situation with a still greater degree of strength, for purposes sufficiently obvious. It covers the diaphragm, where it is more opaque, and, in connexion with the pleura, lines the ribs, and, turning, forms the mediastina, which thus are shown to consist of four layers, two serous and two fibrous." (P. 460.) This conformation of the investments of the lungs and adjoining parts is interesting in a

physiological and pathological as well as an anatomical point of view. It establishes an additional analogy between the lungs and the parenchymatous and glandular organs of the abdomen, which have their fibrous capsules; and illustrates the general law of the constant association of serous and fibrous membranes, as we see in the arachnoid, pericardium, peritoneum, tunica vaginalis testis, and the synovial capsules. Considered pathologically, Dr. Stokes adds, it may explain the pain of pleuritis and pleurodynia, and the rarity of perforations of the pleura, so remarkable when considered in connexion with the frequency of ulcerations of the lung, which constantly approach so close to the surface as to be bounded by the fibro-serous membrane alone. "In pleuritis, with effusion, its existence may assist in explaining the binding down of the lung, and its corrugated appearance after the removal of the effusion." It may also be the seat of ossifications of the pleura; indeed, there can be little doubt of this being the case.

5. Notwithstanding this structure of the thoracic linings, we find that the cavities are capable of considerable dilatation, and that the mediastinum yields much more than is generally supposed, before the pressure of intra-thoracic accumulations. Hence, in empyema, or in pneumo-thorax of the left side, displacement of the heart, as Dr. Stokes has shown, occurs long before the intercostal spaces are obliterated, or even the diaphragm depressed. It is not improbable, however, that the strength of this fibrous tissue varies in different persons; indeed, with respect to the pericardium, the greatest difference of strength exists, for in some subjects it is dense and opaque, while in others it is nearly transparent.

6. *The varieties or states of pleuritis* are numerous; and they have been variously denominated and arranged, according to the views of those who have described them, and to the various morbid relations they furnish.—(*a*) Considered with respect to the character of its *progress* and *duration*, pleurisy may be either *acute* or *chronic;* and (*b*), both the one and the other may also be either *attended by pain* or *without pain*—may be *open* or *latent*.—(*c*) In relation to its *extent*, pleurisy may be *partial*, or circumscribed to a portion only of the pleura of one side, or much more extended on one side, but still *single*, or it may exist on both sides, or be *double*.—(*d*) As regards the characters of the *pathological changes* attending it, pleurisy may be *dry*, *adhesive*, or *pseudo-membranous*, or it may be *effusive*, *serous*, *sero-puriform*, or *purulent*.—(*e*) In relation to the *causes* and *circumstances of its occurrence*, pleurisy may be *primary* or *consecutive*, or it may be *spontaneous* or *traumatic*. (*f*) In respect of *antecedent disease*, it may be consequent either upon other diseases of the chest, or upon constitutional maladies, more especially the eruptive fevers.—(*g*) Pleuritis may, moreover, be *simple* or *complicated;* and it may be *simple* from the commencement and continue so, or it may become complicated in its course, and it may be *complicated* from the beginning, or it may be consequent upon the malady associated with it; thus it may be associated with *catarrh*, *pneumonia*, *bronchitis*, *tubercles*, *pericarditis*, *diaphragmitis*, *hepatitis*, *rheumatism*, &c.—(*h*) Pleurisy may be even characterized according to the *states of the system* and *the diathesis*, and the circumstances in which it occurs: thus it may be *sthenic*, or *asthenic*, or *bilious*, or *typhoid*, or *malignant*, or *cachectic*, or *puerperal*.—(*i*) It may, lastly, be *true* or *false*.

7. Having premised these remarks, I shall first notice the *causes* of pleurisy, and afterward describe the principal *forms* and *states* which this disease assumes, with their *terminations*, their *diagnosis*, and the *appearances on dissection*, concluding with the *treatment* which appears most appropriate to each of these states.

8. I. The General Causes of Pleurisy.—Pleurisy occurs in all *ages* and in both *sexes*—in infancy and childhood as well as in adult age; and in this latter somewhat more frequently than in old age. It is much more frequent in males than females, probably in the proportion of five to three, and owing to the greater exposure of the former to the exciting causes. It is most prevalent among persons much exposed to the vicissitudes of season and weather, and those actively engaged in out-door occupations, more particularly such as require physical exertion. It is met with somewhat oftener in those of a sanguine temperament, and robust or plethoric habit of body, than in others; but this may admit of some doubt. It occurs more frequently in winter and spring than in the other seasons, and in this it accords with pneumonia, both these maladies occasionally becoming so prevalent in those two seasons as to be almost epidemic. Nevertheless, pleurisy may be more than usually prevalent, also, during summer and autumn, as it manifestly was during the spring and summer of 1846, during which seasons, however, there seemed to be a tendency to inflammatory affections of serous membranes, and these often of an asthenic character.

9. *A.* The *various circumstances which predispose* pleurisy are not determined with precision. There can be no doubt, however, that previous disease of the respiratory passages or substance of the lungs, or the actual presence of these and eruptive fevers, are the most frequent and influential. To these may be added the arrest of accustomed discharges, and the suppression of cutaneous eruptions and of painful affections, before the constitutional derangement of which they are the external manifestations is removed, for there are often predisposing causes, although they may not actually excite or determine this malady, other causes commonly following upon these, and determining the morbid action to the pleura or other serous membranes.

10. *B.* The most influential *exciting causes* are certainly exposure to cold in the numerous modes of its application, &c., and external injury.—*a.* The vicissitudes of season, of temperature, and of other atmospheric conditions, have a marked influence on the prevalence of this disease. It is generally supposed that cold and dry states of the air occasion pleurisies more frequently than cold and humid states. This is probably the case, but it is not demonstrated, nor is it easily demonstrable, as there are generally numerous other circumstances which should be taken into the account. There can be no doubt, however, that cold applied to the surface of the chest, or the cold generated by currents of air passing over this part of the

body, or even over other parts, and damp or wet clothes upon either the trunk or the extremities, more especially when the surface has been perspiring at the time, or shortly before, are frequent causes of pleurisy.

11. *b. Injuries or other mechanical causes* are frequent and sufficiently manifest, especially fractures of the ribs, penetrating wounds of the thorax, and contusions. I believe that the influence of the last of these has often been underrated, and that contusions and superficial injury even of a slight kind have occasioned pleurisy more frequently than has generally been supposed. In some states of the constitution, by no means recognizable previously, superficial and painful injuries, such as severe burns, scalds, and lacerations of the surface, are followed by inflammation of the pleura; and in some instances the injury may have been so severe as to have its effects propagated to the intercostal muscles, and thence to the costal pleura; but, in other instances, this explanation can hardly be entertained, although the frequency of pleurisy subsequently to such injuries fully justifies a belief in the sequence being that of cause and effect, while nervous communications, connexions, and influence sufficiently account for the phenomenon.

12. *c.* The *pathological causes*, or antecedent diseases, require some notice in relation to the occurrence of pleurisy, more especially as the most frequent appearances of this malady are of this description. The common supervention of pleurisy upon general and lobular pneumonia, upon tubercles in the lungs, the rupture of a tubercular cavity, or tubercular perforation of the lung, and upon other organic lesions of this organ, is well known. But it is not always sufficiently recollected, at least it has not been sufficiently noticed by authors, that pleurisy is often consequent upon inflammations of the liver, of the diaphragm, and of the pericardium, and still more frequently upon rheumatism. Pleurisy may either follow or coexist with these, and more frequently with inflammation of the liver and diaphragm than is generally supposed. It may also follow partial or general peritonitis, and become the most dangerous part of the complicated malady. It is well known that diseases of the mamma, more especially the malignant maladies of this organ, often extend to the pleura, and occasion one of the worst forms of pleuritis; and pleurisy, generally with effusion, is one of the most unfavourable consequences, and not the least unfrequent, of inflammations of the veins and of the lymphatics, of punctures or the inoculation of morbid fluids during dissections, and of organic diseases of the kidneys.

13. *Eruptive fevers* are among the most frequent pathological causes of pleurisy, this disease commencing either during the acme of the eruptive fever, or during the subsidence of the eruption, or even during the period of convalescence. When the pleurisy appears during the acme of eruptive fevers, it may be manifest, or be marked by the other phenomena, or be latent, and be detected only after death; and it may be similarly circumstanced when occurring at any period after the decline of the eruption. In the first instance, the concomitant pleurisy is to be imputed to the morbid poison in the circulating fluids that has affected the pleura in addition to the external surface, and, indeed, other surfaces of the body. In the later appearances of pleurisy in connexion with, or subsequent to, an eruptive fever, it may be inferred that the morbid condition of the circulating fluids had not been removed by the changes which had taken place on the cutaneous surface, and by the other emunctories, but that it was still sufficient to implicate the pleura, especially if exposure of the surface, in its existing state of susceptibility, favoured determination of the circulation to internal parts. Moreover, the cutaneous function is often not restored for some time after eruptive fevers; hence the blood retains much uneliminated materials, which act injuriously upon serous exhaling surfaces, and often inflame them; and this evil and its consequences are always developed or aggravated by exposures to cold, even of the most evanescent and slightest kind, during the early periods of convalescence from these fevers. Besides, the sympathies existing between the skin and serous membranes, already insisted upon (§ 11), are also to be taken into the account when speculating on the connexions of inflammations of these surfaces.

14. The *puerperal state*, more especially the first month after delivery, is not an unfrequent cause of pleurisy; inflammation of the pleura occurring then either in a simple form, or associated with peritonitis, or with pneumonia, or with phlebitis, &c. In this particular state there can be no doubt of the disease being caused, in great measure, by the condition of the blood consequent upon the absorption of morbid matters from the uterus, and even in part from the digestive canal, aided probably, in some cases, by suppression or interruption of the eliminating or depurating functions of the skin, kidneys, and intestinal canal. In many instances, also, of puerperal fever, more especially of the adynamic and malignant states of that disease, pleuritis appears both as a complication or prominent local lesion, and as a consecutive malady; and thus pleurisy, appearing after parturition, may be viewed as resulting from analogous changes to those which occasion it in connexion with eruptive fevers, erysipelas, and some other diseases of the skin, namely, from the states of the circulating fluids, aided by interruption or suppression of the actions of the skin and other emunctories.

15. II. Description of Pleurisy.—i. The Structural Changes constituting Pleurisy.—It will be advantageous briefly to notice those changes in the pleura constituting this disease, in the earlier stages, and which exist in all cases in a greater or less degree, however early treatment may arrest their progress. These changes are identical with those characterizing inflammations of the *peritoneum*, and hence it will be unnecessary to do more than to notice them briefly. It is probable that, at the very commencement of the inflammation, there is a diminution of the serous exhalation that usually moistens or lubricates the pleura in the healthy state. This being the case, the friction between the opposing surfaces would be increased; but this condition would soon be followed by an exudation of lymph, or of an albuminous serum, which would assume various forms with the intensity and continuance of that inflammation, and the habit of body and

vital powers of the patient. The pleura, more especially in its subjacent or more fibrous layer, and the connecting cellular tissues, becomes more vascular, more opaque, and somewhat thickened, at least subsequently, and the lymph effused more copious. The liquid or lymph poured out consists of serum—an augmentation of the serous exhalation—and of a material of nutrition, the albuminous, the coagulable, or albumino-fibrinous portion. If the inflammation continue, even for a short time, the exudation of these materials, in variable proportions in different cases, proceeds rapidly, and gives rise to changes depending much upon the proportion of the latter material contained in the serous fluid. In its smallest proportion, the coagulable material is held in solution by the effused fluid; and, when withdrawn from the body, it gelatinizes upon cooling, the liquid mass assuming a jelly-like appearance. When the coagulable portion is more abundant, it forms films or coats of lymph upon the surface of the membrane; and this deposition is generally the more considerable, and the more disposed to speedy organization, the more acute the inflammation, the more plethoric and robust the patient. This coagulated lymph thus forms the false membranes, and the substance of the adhesions so frequently formed between the surfaces of the inflamed pleura. But the false membranes may exist with or without adhesions, the existence of adhesions depending much upon the quantity of the fluid effusion between the pleural surfaces. This effusion, especially when considerable, will generally gravitate to the most depending portions of the pleural cavity; and there, especially, it will tend to keep the pleuræ separate. But if the upper portions of the pleura be inflamed, they will more readily adhere, unless the fluid be very abundant. If the pleuræ be inflamed only in their lower expansions, a small quantity of fluid will be sufficient to keep them apart. When the lymph effused on the inflamed surfaces becomes organized it forms a false membrane; and if the lymph cover opposite surfaces, adhesions, through the medium of these membranes, often become firm or permanent. When the liquid effusion is small, or even considerable, various adhesions may be formed, and vary in number, appearances, and extent, in connexion with the effusion; or partial adhesions, coexisting with false membrane, may exist without any, or with very slight, effusion. In more prolonged cases, and in various other circumstances, which will appear in the sequel, various consecutive changes are observed in the pleura, and in the matters effused in its cavity; but these will be more fully noticed hereafter.

16. ii. The Symptoms and Signs of Pleurisy.—*A.* Of Simple Acute Pleurisy—or Sthenic Acute Pleurisy.—This, as well as other inflammations, generally commences with chills or rigours, the continuance and severity of which are generally in proportion to the severity of the attack. The rigours are either preceded, or accompanied, or followed—for no precise order of procession of their symptoms is observed—by pain or stitch in the side, aggravated by inspiration and cough. To the rigours succeed heat of surface and the usual phenomena of sympathetic inflammatory fever, which vary with the constitution, idiosyncrasy, and vital power of the patient. The respiration is short, frequent, sometimes nearly forty in a minute, superficial, and anxious. Inspiration is interrupted, or, as it were, cut short by the lancinating pain. Cough is dry and suppressed. The chest, on percussion, furnishes a dull sound on the affected side; and, at the same time, there are diminished motion and sound of respiration, with other morbid signs, on that side. The accompanying fever is attended by nocturnal exacerbations, with more or less manifest remissions. From the fifth to the ninth day the fever subsides, either with or without critical changes. The pain of the side abates, and with it the feeling of oppression or tightness, and expectoration and respiration become more easy. Still the local changes, evinced by percussion and auscultation, remain, and often continue for a considerable period; and even, to a certain extent, during life. But more commonly they gradually disappear, and the patient recovers health and strength. Dulness on percussion is the sign which is the last observed, the breath-sound returning often long before the dulness entirely disappears. These phenomena result from the several products of inflammation collected in the cavity of the pleura, that are generally removed during the period of convalescence. This view of the symptoms of pleurisy requires, however, a more particular examination, in respect both of the diagnosis and of the treatment.

17. *a.* The *pain or stitch in the side*, characteristic of this state of the disease, indicates a more or less developed period of it. This pain is sharp or lancinating, often severe, recurs at each inspiration, and prevents the dilatation of the thorax, thus confining inspiration within certain limits. Its seat is most frequently under the nipple, at the margins of the lateral attachment of the diaphragm. It has been asked, to what is this pain owing? M. Cruveilhier answers this question by referring it to the friction of the costal pleura over the pulmonary pleura, which he believes to be greatest at this situation. But I doubt the existence of much friction between these surfaces, and believe that the pain is to be imputed chiefly to the stretching of the inflamed fibrous layer of the membrane during inspiration, and to the development of its morbid sensibility by this act. The pain may be felt in other situations besides that now mentioned. It may exist at any part of the affected side of the chest. It may even extend to the lumbar region, or to the lower margins of the ribs and down to the crest of the ilium; and it may exist in the mammary and sub-sternal regions, and rise as high as the margins of the third or second rib, extending even to the shoulder. The pain varies as to intensity and duration: it may be permanent or temporary, remittent or intermittent. It may be so intense as to threaten suffocation or asphyxia, either from attempting to move, or owing to the inability to dilate the chest. This, however, is most remarkable in extreme cases, and in those of *double pleurisy* (§ 61). In other instances the pain is comparatively slight, and is felt chiefly during a full inspiration, or upon coughing or sneezing, &c. In some cases the pain extends over nearly the whole of the side, and is increased upon pressure, especially on the

intercostal spaces, upon percussion, &c. I have seen, also, the pressure of the stethescope endured with difficulty, and a certain degree of puffiness or œdema of the side or of the external parietes. In a case of pleurisy consequent upon hepatitis, very recently under my care, this external œdema and tenderness were very remarkable. I have imputed these phenomena to inflammation of the costal pleura, and to the external propagation of several of the local changes, especially excited vascular action, increased sensibility, and serous infiltration to the sub-cutaneous cellular tissue. Moreover, the pain may be entirely absent, or may exist in a situation which may not suggest the existence of pleurisy ; and hence the disease has been called *latent pleurisy*, which will be considered hereafter (§ 49.)

18. *b. Respiration* is short, interrupted, superficial, and very frequent. It may even reach fifty in a minute. The frequency of respiration is generally in proportion to the severity of the pain, which checks the dilatations of the chest, and creates a necessity for an increased frequency of the act. In these cases a sudden attack of cough or sneezing almost threatens asphyxia; but I cannot agree with M. Cruveilhier, that asphyxia ever occurs under these circumstances, unless in double pleurisy, when much effusion has taken place. Great frequency of respiration may, however, exist independently of pain; but in this case there is generally considerable effusion. Hence this state of respiration, although no pain is complained of, should always induce a suspicion of the existence of pleurisy. When the remarkable acceleration of breathing is caused by the effusion, then attacks of cough, sneezing, &c., may be followed by fatal asphyxia, but this issue more frequently supervenes without either of these contingent causes having occasioned it.

19. *c. Cough* most frequently attends pleurisy ; but it is short, dry, and suppressed, owing to the pain it causes. It sometimes, however, brings up some bronchial or tracheal mucus, and when pleurisy is complicated with catarrh, then the cough is much more severe and distressing, and often attended by a copious expectoration of the sero-mucous fluid of catarrh. Occasionally the catarrhal symptoms are not developed until the acute stage of pleurisy is subsiding, and when a free, abundant, and copious expectoration then takes place, it may be viewed as being critical ; but when the sputum is viscous, adheres closely to the vessel, is rusty or streaked with blood, it may then be considered an indication of the extension of the inflammation to the substance of the lungs, and to the minute bronchi.

20. *d. Immobility of the thorax* on the affected side has been considered characteristic of pleurisy ; but this is the case only to a certain extent, and is not to be depended upon, for in many severe cases it is difficult to see much difference in the degree of motion of both sides, or of different parts of the same side. Besides, immobility is often caused by pain, which may exist in the side independently of inflammation, as will appear hereafter.

21. *e. Decubitus* is most frequently on the back during the acute stage of pleurisy ; sometimes it is upon the sound side, and rarely on the affected side as long as pain is considerable ; but when effusion has taken place, and the acute stage has passed away, the patient can lie only on the back or on the side in which the effusion exists. Indeed, in all chronic cases of pleurisy, or whenever effusion into the pleural cavity is great, the lung on the sound side only remains capable of performing the respiratory functions, and it necessarily requires to be unembarrassed during the discharge of these functions, either by position or any other circumstance.

22. *f.* The *fever* attending pleurisy may precede, for two or three days, the local symptoms, or accompany them. It generally subsides, before these symptoms disappear, for a longer or shorter period. The heat of surface varies considerably, but generally it is co-ordinate with the strength and hardness of the pulse, and is increased towards evening or night. The fever is seldom perfectly continued ; it is generally slightly remittent ; sometimes more manifestly so. It is much less frequently intermittent, although the latent form of the disease often presents complete morning or daily intermissions. The pulse is hard, concentrated, or constricted, and more or less accelerated, while in pneumonia it is full and developed. Hardness of the pulse was considered by Baglivi as the most distinctive symptom of pleurisy. The concentration and hardness of the pulse are generally remarkable in proportion to the acuteness of the pain. When effusion takes place, or is considerable, especially about the third or fourth day, or later, the febrile symptoms subside, or remit more decidedly, and sometimes the pulse intermits. These phenomena may be referred to the influence produced by the effusion upon the functions of the lungs and heart, and consequently upon the blood itself. The least mental or physical agitation, however, occasions great acceleration of the pulse in these cases, and a febrile exacerbation returns at night.

23. Although the sharp pain in the side, catching and restraining every inspiration, and rendering deep breathing or coughing almost intolerable ; the short breath, and short dry cough thereby caused ; the hard and quick pulse, heat of skin, &c., are often characteristic of pleurisy ; yet acute inflammation, and its most important consequence, copious effusion, may have existed for many days in the pleura, without this array of symptoms. Even effusion may have taken place to a very great amount without either disturbing the respiration very sensibly, or even rousing the sensibility of the parts, if it have proceeded gradually or slowly. On the other hand, the *physical signs* are more to be depended upon than those symptoms which have been now considered. And, although they do not indicate the intensity of the inflammation, they seldom fail in announcing the presence, and most serious consequences of it. I shall therefore analyze these signs in the order in which they commonly appear.

24. *B. Physical Signs of Pleurisy.—a. Diminished motion* is usually observed as already stated, and is at first to be imputed to the pain ; but, as pain may exist independently of inflammation, this sign cannot be depended on. The sound of respiration is also diminished in pro-

portion as the movements are restrained in the parts affected with pain.

25. *b. A sound of friction*, or a creaking sound, is sometimes heard during the movements of the chest. This is ascribed by Dr. Stokes, M. Reynaud, and others to a defective lucubration of the opposite pleural surfaces during the early or incipient stage of inflammation—to a *dry pleurisy*. Dr. Williams ascribes this sound to the presence of lymph, and believes that its production is favoured by the lung being partially distended or pushed against the walls of the chest during respiration. It is most apt to occur where the lung is confined by adhesions or false membrane, or partially distended by tuberculous or other deposits. This sound is commonly heard about the middle parts of the chest. It generally ceases as soon as effusion into the pleural cavity is announced by percussion; but in the dry pleurisy it may continue for a long time. Dr. Williams remarks that, in three cases in which the sound was heard a few days before death, the pleura were thinly coated with a few small patches of soft granular lymph; and that, on gently rubbing the lung upon the costal pleura, a friction-sound was produced by the patches, but by no other part of the pleura. The pleural inflammation and effusion were very slight in these cases.

26. *c. Dulness on percussion*, at the most dependent parts of the affected side, is present when effusion has taken place; but there may also be some dulness on percussion of other parts, or where a considerable effusion of lymph, or false membrane, is interposed between the opposite surfaces. The effused fluid collects in the lowest part of the cavity, floating, to some extent, the lung upon it; and hence the dulness in that part. As, however, the vesicular and peripheral parts of the lung yield more readily to pressure than the tubular or more internal parts, the fluid mounts up, as it accumulates between the lung and ribs, and occasions more or less dulness, which is then distinctly heard if the percussion be gentle and abrupt. But in all cases the sound should be compared with that emitted by corresponding parts on the sound side.

27. *d. Diminished sound of respiration*, with diminution of the extent of the motions of respiration, necessarily result from the accumulation of fluid in the pleural cavity. The breath-sound is more and more weakened and shortened as effusion proceeds, and is ultimately abolished in most parts, excepting those about to be noticed. This sign, as well as that preceding and those following it, may be modified, or rendered less distinct, by adhesions previously existing between the pulmonary and costal pleura.

28. *e. Ægophony*, or the modification of the vocal resonance so denominated, occurs when the dulness on percussion and diminution of the respiratory sound reach the middle regions of the chest. The vocal resonance is heard more distinctly than usual in those regions, "and it is superficial, as if produced in the spot, separately from the oral voice; and it is changed to a small bleating, trembling note, which so much resembles the voice of a goat, that Laennec termed it ægophony. This modification of the voice is heard most distinctly between the third and sixth ribs, which corresponds with the situation of the middle-sized bronchial tubes; about the spine it is generally mixed with more of a common bronchophony from the larger tubes at the root of the lung." The liquid interposed between the lung and the parietes of the chest renders the voice more audible in the above situation, by condensing the tissue of the lung, and thereby making it a better conductor of sound. The layer of fluid thus interposed, being thrown into vibration by the sound propagated from the bronchial tubes, transmits the voice to the ear of a tremulous and wiry character, or imparts to the voice, heard upon auscultation in this situation, this particular character. The high or sharp tones of the voice are best transmitted in this way. Hence ægophony is most evident in boys, women, and children with high voices. In persons with a bass voice it is more commonly limited to the inferior angle of the scapula, or near the spine; and it then approaches nearer to bronchophony from its being seated in larger tubes.

29. As the liquid increases, the ægophony becomes weaker, more distant, and loses much of its tremour, the sound much resembling a small, deep-seated voice, or a silvery echo of the original. This is owing to the amount of effused fluid, and to the compression of the lungs and tubes; and when these are much increased, the sound ceases altogether. It has not been ascertained what quantity of effusion is sufficient to produce this last effect. Dr. Williams thinks that much sound of the voice is not transmitted when the layer of serum exceeds an inch in thickness. If the ægophony continue stationary for several days, it may be inferred that the effusion is moderate, and increases very slowly, which is a favourable sign. But it is often very transient; and cases often do not come under treatment until the pleuritic effusion has become too great to give rise to ægophony. Former and existing adhesions, however, modify this as well as the other physical signs. When ægophony is most distinct it is often accompanied with bronchial respiration, especially between the scapulæ, where, also, there is a good deal of common bronchophony with it. Indeed, ægophony is merely the bronchial voice modified by transmission through a layer of fluid; and hence it may be changed into bronchophony by causing the patient to change his position so as to allow the fluid to gravitate to a different part of the cavity. Hence, also, ægophony and bronchophony often present mixed and doubtful states, which do not admit of easy distinction, although they differ sufficiently when their respective characters are well marked. The former may be stated to be a *tremulousness* of the voice when it is superficial, and an echo-like smallness when it is deep-seated; while the latter may present several other varieties.

30. *f. The diffused vibration of the voice*, which is usually felt by the hand applied to the chest, is generally intercepted and prevented by effusion into the pleural cavity. M. Reynaud first pointed out this sign, and showed that the vibration caused by the voice pervading the common tissue of the lung, and transmitted to the parietes of the chest, is muffled and destroyed by a layer of fluid interposed between the lung

and the parietes, although ægophony may be heard at the same spot, the vibrations of the latter being too fine to be felt by the hand. When dulness on percussion is caused by solidification of a portion of the lung, the vocal vibrations are transmitted with unusual force from the tubes to the walls of the chest, and hence the opposite effect occasioned by the fluid interposed becomes an important diagnostic sign, in regard of these lesions. Partial adhesions, however, of the lungs to the costal pleura may very materially interfere with these phenomena; for there may be even more vibrations than usual felt at the adhering parts, or where the lung is pressed close to the walls of the chest; and, on the other hand, there may be solidification of the lung, and fluid or other obstruction in the bronchi may prevent the fremitus of the voice from being transmitted through them; or more or less fluid may be interposed between the solidified lung and the walls of the chest.

31. *g. Ægophony and all sounds of the voice cease* throughout the affected side as the liquid effusion increases, excepting within two or three inches of the spine; or where the lung may adhere to the walls, which frequently happens at the upper parts of the chest. The sound of respiration is not heard in all the parts of the affected side, except the interscapular region and under the clavicle; but it is much weaker in these parts.

32. *h. Enlargement and immobility of the affected side* may always be detected when the effusion is considerable. This side is first seen to be larger than the other at the end of expiration, it not diminishing equally with the sound side, especially at its lower region. The difference between the sides may be rendered more evident by encircling the chest by a piece of tape, and by fixing it at the spine and sternum; when the tape will slacken and tighten with expiration and inspiration, more evidently on the sound than on the diseased side, which latter remains more fixed in proportion to the amount of effusion and degree of distention. As the effusion augments, the enlargement of the side becomes the more obvious to the eye during the respiratory act, the want of symmetry being apparent in whatever position the side is viewed from; but the amount of difference should be ascertained by measuring the chest horizontally with a piece of tape. Having made the tape, or riband, to meet at the middle of the lower end of the sternum, it should be taken at the precise point of its crossing the spinous processes of the vertebræ, and the difference of length between the two sides will give the amount of enlargement; recollecting, however, that the right side of an adult is about one third of an inch larger than the left.

33. *i. Displacement of the parts and organs bounding the effusion* becomes more and more manifest as the amount of fluid increases. Laennec, and many after him, have remarked that the intercostal spaces on the side of the effusion do not present their usual depressions, and that they are sometimes, especially in chronic cases, equal with the surface of the ribs, or even more prominent than they are; but this sign is hardly perceptible in acute cases, unless in the more asthenic states, and when the patient is thin or emaciated. In such cases, Dr. Williams has noticed an evident fluctuation, which, however, is a rare occurrence. The smoothness of the side, from the yielding of the intercostal muscles and consequent obliteration of the spaces, as well as the yielding of the diaphragm, and the pushing before it of the viscera of the upper regions of the abdomen, are remarkable when the effusion is great, and are ascribed by Dr. Stokes to paralysis of these muscular parts, consequent upon the inflammation of their serous linings. "The true explanation," he remarks, "of the protrusion of the intercostals and diaphragm will be found to be that they are affected by paralysis following inflammation of a contiguous structure—that their contractile powers are lost, and that hence they yield easily to a pressure, which in their healthy state (as in vesicular emphysema, in hydrothorax, and the first stage of pleurisy) they effectually resist." (P. 464.)

34. Displacement of the organs more immediately adjoining the effusion, especially that of the heart and of the liver, is one of the chief indications of the existence and of the amount of liquid effusion into the pleural cavity, and was first noticed by Dr. Stokes and Townsend. When effusion is considerable in the left side, the consequent displacement of the heart renders its recognition easy. In this case the pulsations of the heart are felt and heard most distinctly under or to the right of the sternum, or as low as the epigastrium, instead of between the cartilages of the fourth and sixth left ribs. If the effusion be on the right side, the liver is pushed down much below the margins of the ribs, and its position is easily traced by percussion and by the touch. It may even be pushed so far as to form a tumour in the abdomen, and hence lead to a serious mistake in the diagnosis, if the symptoms and signs referrible to the thorax be not duly investigated. When effusion in the right cavity is very great, the heart may also be pushed farther than usual to the left, and it may be felt beating to the left of the nipple, or even below the axilla. The mediastinum may also be displaced by a copious effusion, so that a dull percussion sound will be given out over nearly the whole of the sternum, and even for half an inch beyond it upon the sound side, owing to the mediastinum being pushed to this side by the effusion, which thus occupies the space behind the sternum. The dulness on percussion in these cases is most evident below the juncture of the second rib with the sternum. The above displacements may also be caused by air in the pleural cavity, but in this case the tympanitic sound would be present instead of dulness.

35. *k. The motions and sounds of the healthy side*, especially when compared with those of the affected side, indicate either no sign of disease, or an increase of the signs of healthy action, owing to the increased work performed by the sound side. This side moves more fully and rapidly than usual, and the respiratory sound is so loud in it as to resemble the respiration of children.

36. *l. Old, or even recent, adhesions* very remarkably modify the physical signs of pleurisy. When the adhesions are loose, or are stretched by the effused fluid, so as to form bands traversing the effusion, or cells filled with fluid, the lung may be thereby kept at a moderate dis-

tance from the parietes of the chest, and ægophony would thus be continued as long as this state continued. Where the adhesion is extensive and close, fluid poured out in the vicinity will compress one part of the lung, and stretch and ultimately compress the part adjoining, in or near the place of adhesion. Thus, as not infrequently observed, adhesions may be found in the upper regions of the chest, and the fluid effusion in the lower parts may be so great as to press the lungs against the upper portion, and there occasion a loud bronchophony and bronchial respiration transmitted from the large tubes by the adhering dense column of lung; and thus the case may be mistaken for one in which cavities exist underneath this situation; but the prominence of the intercostal spaces, the dulness on percussion, the enlargement of the side, and the displacement of parts, as above described (§ 32, *et seq.*), will readily distinguish its real nature.

37. In rarer instances, the pleura of the upper and posterior parts of the lung may be affected, and that of the inferior portions may be adherent to either the diaphragm or lower walls of the chest. In these the lung will be pressed, by effusion into the upper and posterior parts, against the anterior or other portion of the walls of the thorax, according to the seat of effusion, and to the manner in which the fluid is bounded by the adhesions or false membranes; and the sounds will be tubular, loud, or clear, or otherwise vary, with the part of the lung thus pressed to the sides of the chest, and with the proximity of the larger bronchial tubes; and a more or less loud bronchophony will also be heard.

38. *C. Consecutive Changes in Acute Sthenic Pleurisy.*—If inflammatory action subsides in consequence either of the treatment or of the effusion which takes place, *absorption* of the fluid and of the lymph usually results, and the compressed lung expands under the efforts of respiration in proportion as absorption proceeds. The signs evincing the increased effusion gradually disappear; and ægophony and the sound of respiration return in the situations, generally the upper parts of the chest, where they were last heard. With the return of these, the side assumes its natural appearance, and a gradual improvement takes place of the sound on percussion. In modern cases, as Dr. Williams remarks, the fluid is absorbed before—indeed, long before—the lymph or albuminous matter is removed; and when the pleural surfaces covered with this matter come together, a rubbing or rustling sound is sometimes heard, which soon ends in the adhesion of these surfaces by bands, or by more continuous false membranes. If these false membranes are formed after the fluid has been removed, and the lung has recovered its full expansion, they are adapted to its free motions, which are not materially interfered with by them. Hence adhesions are often formed, which are lengthened in the lower parts of the chest, where the lungs descend somewhat as the ribs rise, and which are short in the upper parts, where the lungs more closely follow the movements of the parietes.

39. In severe cases, the inflammation continues after the effusion has become abundant; and not only increases or perpetuates the fluid effusion, but also throws out "albuminous matter in various conditions, which by its present qualities or subsequent changes may produce a variety of prejudicial effects, all tending more or less to interfere with the restoration of the organs to a healthy state." These consequences arise from the continued or unsubdued inflammation, whether it has been imperfectly treated, or entirely neglected; and they furnish strong proofs of the value of the physical signs, which are never absent, and which rarely fail to point out the existence of these consequences. They will come more appropriately under consideration under the heads of *Chronic Pleurisy* (§ 63, *et seq.*).

40. *D. Termination of Acute Sthenic Pleurisy.*—The most frequent terminations of this form of pleurisy are, 1st, by resolution; 2d, by passing into the chronic state; and, third, by fatal asphyxia.—*a. Resolution* may be complete, the effused fluid and the false membranes being absorbed, cellular adhesions being the only traces left of the disease, or it may be incomplete. In this latter case, the fluid effused is absorbed, but the false membranes remain, undergo changes, and occasion phenomena which will be noticed when the *second* of these terminations are considered.—*b. Death by asphyxia* may occur in the most severe cases, either in double pleurisy, or in the single state of the disease when the effusion is rapid and very great; but this termination is much more frequent in pleurisy than in pneumonia. It is, moreover, very rare in the acute stage and simple form of the disease: it occurs chiefly in the chronic stage, and in the more complicated states.

Before I proceed to describe the changes observed in the pleura and in the matters thrown out on the surface of this membrane after inflammation of it, I shall first notice the several states or forms of pleurisy which differ from that which has now been described, as being the more common type of the disease. Certain of these, indeed, differ from that just considered in very little farther than in the seat or limitation of the disease, or in the stage, period, or continuance of it; and hence the necessity of considering them all in close connexion.

41. ii. Dry Pleurisy—*the Pleurisie sèche of* Andral.—*a.* This *state* of the disease deserves notice chiefly because it has been particularized by Dr. Stokes and M. Andral; for it can hardly be considered a distinct *form*, but rather as being particular periods, of pleurisy modified, more or less, by peculiarity of constitution and by the grade of inflammatory action. Dr. Stokes remarks that this term may be applied to that form in which nothing is effused but lymph. The characters of this state, in general, are, that the constitutional and local distress is comparatively slight, that organization rapidly advances, that the sound is clear, or nearly so, on percussion, the phenomena of accumulated effusion being wanting, and that the friction signs are evident. Dry pleurisy occurs, according to these writers, as an original and uncomplicated disease, or as consecutive of fever, erysipelas, or diffuse inflammation. It may be associated with or succeed to any of the diseases of the lungs, or occur as a complication of cardiac or hepatic disease. The circumstances in which I have met with it, in the

least equivocal form, are either associated with, or consequent upon, acute rheumatism, acute hepatitis, and pneumonia.

42. *b.* The *physical conditions* of dry pleurisy Dr. Stokes believes to occur in two stages of the ordinary disease, namely, in the earliest periods, before effusion takes place; and in the latter stages, when the liquid effusion is absorbed. In the first case, the duration of the friction phenomena depends on the rapidity of effusion; in the second, on the vigour of the constitution which influences the process of organization. At the commencement, pain is often felt in or near the situation of the inflammation, but it soon subsides. The characters of the friction-sound, generally soon afterward heard in the situation of the pain, are various; but this sound always conveys the idea of two rough or dry surfaces moving uninterruptedly upon each other. It accompanies inspiration and expiration, but it may be absent during ordinary breathing, and yet become manifest on forced respiration. In some instances the rubbing sensation is felt by the patient for a long time, but the sound may often be heard long after he ceases himself to feel the obstruction. Dr. Stokes states, that the friction-sound in the early stages of the simple disease, or immediately after the absorption of an empyema, is often accompanied by a rubbing sensation, perceptible to the hand. Like the former sign, this may be absent during ordinary breathing, but become manifest when the patient inspires deeply. In the progress towards cure, this is the first of the physical signs to subside; it is apparently connected with the least organized state of the effused lymph.

43. The duration of the friction-sound, depending upon the absorption of the fluid and the rapidity of organization, varies remarkably in different persons; it is comparatively short in the young and robust; while in the feeble and cachectic it may continue without changing, especially when the disease is consecutive or complicated, longer than a month. It is rarely heard, or continues but a short time, at the commencement of pleurisy, attacking the cachectic, or complicating febrile maladies. When, however, it follows the absorption of an effusion, it may continue from several days to some weeks. It is heard most distinctly over the middle parts of the chest. The friction is rarely heard when the dry state of pleurisy is consequent upon pneumonia with hepatization of a considerable portion of the lung. It is more distinct when the pleurisy is consequent upon, or complicated with, acute hepatitis. When pleurisy is associated with pericarditis, the rubbing sounds seem double, but the combination of that caused by the action of the heart, with that following respiration, often causes a confusion, which requires attention and practice to distinguish and duly recognise.

44. *c. The causes of the friction-sounds* have been differently stated by pathologists. These sounds, variously modified with the nature of the case, have been heard in certain states of inflammation of the pleura, pericardium, and peritoneum; and as they have not been heard in those states which are attended by a copious liquid effusion, but in that in which an unorganized lymph is presumed to exist on the surface of the inflamed membrane, so they have been viewed by M. Renaud, Dr. Corrigan, and Dr. Stokes as being caused by the presence of this lymph in the situations where these sounds are heard. Still this cause admits of doubt; for the *creak*, or *leather-creak*, admitted to be one of these friction-sounds, is rather to be viewed as given out by the membrane itself in certain morbid states of it, than by the friction of the opposite surfaces when covered by unorganized lymph. The fact, however, of Dr. Corrigan having produced the sounds in question by rubbing two portions of the inflamed membrane one upon the other, may appear conclusive of this point; still, I believe the matter still to require farther examination.

45. *d. The existence of dry pleurisy*, it should be mentioned, even as a *stage* of pleurisy, has been doubted very recently by a no less distinguished pathologist than Professor Hasse. He remarks, that the attempt has been made to reckon the progress of pleurisy by defined stages; first, the period of dry inflammation, which is of shorter or longer duration, and comprehends all the changes observed in the pleura and sub-serous cellular tissue (*see* § 112), but without, as is supposed, any serous effusion. Now, he adds, that he has never encountered this dry stage as described, having always, even at the very outset, found the serous fluid somewhat, however slightly, augmented in quantity, and marked by its deep yellow tinge and its increased consistency. There were, likewise, present those grayish or yellowish points, the initial and quickly-expanding rudiments of membranaceous formations. "The so-called *dry pleurisies* of Andral (*Clin. Med.*, 4mo edit., t. iv., p. 405)," he continues, "are, therefore, probably to be understood in a comparative sense only—effusion too scanty to be detected by physical signs during life. Such a ground of distinction is, however, obviously opposed to the strict principle of pathological anatomy." The second stage has been viewed as eminently that of effusion, which, although not confined to any one period, is not sufficiently copious and characteristic to constitute a secondary and distinctive stage until the original inflammation has become thoroughly developed. But to divide the period of effusion into two stages, and thus to attempt to discriminate between the development of liquid effusion on the one hand, and of coagulable lymph and adventitious membrane on the other, are discordant with the process which gives rise to these productions. The third period has been considered to be the organization of the plastic exudation. This, however, does not take place at any particular stage, nor is it a process to which every form of plastic effusion is necessarily subject. It would be difficult to reconcile, in this arrangement, those pleuritic exudations which exhibit traces of organization after the first twenty-four hours, with those in which the organizing powers has been ineffectually exerted for weeks or months. While, therefore, this division might seem justified in some instances by the procession of morbid phenomena, it would in others be quite inapplicable. It would probably be preferable to consider the secondary changes in pleurisy according to the degrees of intensity

of the primary inflammatory act, and to the rapidity with which they ensue upon this act.

46. *E. Pleurisy as above considered*—whether it be attended by little or no liquid effusion at an early stage, by a rapidly increasing and abundant effusion, or by more or less organization of the exuded lymph—generally presents a *sthenic character*, more especially when it occurs primarily, and in a previously healthy constitution. It then, particularly in the young, robust, plethoric, or sanguine temperament, is accompanied with highly inflammatory symptoms, local and constitutional; runs its course frequently with great rapidity, and evinces a greater tendency to the organizing or formative process, even although effusion, to a great extent, may rapidly supervene. The sthenic character may also exist, although in a much less marked degree, in more delicate or even in lymphatic subjects, especially when the disease is primary, but it is then attended by much less fever and less severity of local suffering, the symptoms more nearly approaching the state of the disease next to be noticed. The sthenic character may likewise be evinced in pleurisy consecutive of, or complicated with, pneumonia, hepatitis, pericarditis, or acute rheumatism, in all which, although it sometimes assumes more or less completely, or approaches to, the asthenic character, the sthenic is more frequently observed, unless in the aged, the debilitated, and cachectic.

47. iii. Asthenic Pleurisy.—*Pleuritis Nervosa*, Richter; *Cacheetic Pleurisy*.—This form of pleurisy is generally met with in persons who have been debilitated by previous acute or chronic diseases; in the cachectic, or those subject to some constitutional vice; in persons whose constitutions are broken down by intemperance and dissipation, and more especially in the course of other maladies in which the circulating fluids are contaminated either by the absorption of morbid matters, or by interruption of any of the eliminating or depurating processes. It thus not infrequently supervenes in the course of, or during convalescence from, typhoid or adynamic fevers, exanthematous fevers, puerperal fevers, erysipelas, organic changes in the kidneys, phlebitis, diffuse inflammation, or spreading and diffuse suppuration, and consecutive abscesses. In all these, effusion is more or less rapid, the dry stage hardly or not at all exists, and albuminous exudations either are not formed into membranes and adhesions, or do not become organized unless a change is produced during the course of the disease in the states of vital power and of vascular action. Indeed, in the majority of cases of asthenic pleurisy, the albuminous portion of the exudation is more or less mixed with the serous fluid, the fibrinous or fibro-albuminous character not being present.

48. This form of the disease is seldom attended by acute or painful local symptoms. It is generally *latent*, and often effusion is far advanced, or has long existed before the disease is detected. It is rarely a primary affection, is most frequently associated with some other disorder or structural change. It is sometimes very sudden in its occurrence, and indicated at first by the shortness and frequency of respiration, by the position of the patient, and the sinking of the powers of life, rather than by local distress or pain, or by febrile symptoms, which, if they be present, are usually of an adynamic character. This state of pleurisy, as may be expected from its nature and the circumstances in which it appears, is always removed with great difficulty, or not removed at all, especially if copious effusion has taken place before it was detected. It may supervene in the course of the maladies just mentioned (§ 47), and escape detection until dissection after death discloses its existence, although attention has been directed to its contingent appearance, especially when the effusion has been small, or when it has taken place shortly before death. I have thus met with it in the last stage of malignant or infectious puerperal fevers, in open cancer of the mamma, confluent smallpox, &c. I have seen albuminous exudations covering the pleura in some of these cases, but the serous effusion was abundant, and the membranes formed by these exudations evinced no indication of incipient organization.

49. iv. Latent Pleurisy.—*Pleuritis Occulta*, Richter.—The term *latent* has been applied to pleurisy when it takes place without pain in a situation where it can be referred to the pleura. And this state of the disease is more frequently associated with the *asthenic* than with the *sthenic character;* or, in other words, asthenic pleurisy is much more frequently latent than sthenic pleurisy. M. Cruveilhier supposes that this state of the disease is more frequent than any other. The numerous instances of adhesions between the opposite surfaces of the pleura found on dissection of cases, in which no symptom of pleurisy had been complained of, appears to justify this opinion. Still we often hear of instances of pain in the side ascribed to pleurodynia, or to rheumatism of the intercostal muscles, where a more accurate examination may have detected pleurisy. Besides, pain is often present for a time, and either overlooked or forgotten, or ascribed to some other than the real cause.

50. *Latent pleurisy* may be either *acute* or *chronic*. In its latter state, it will be noticed hereafter. It may be either *primary* or *consecutive*, or *associated* with some other disease. Pleurisy may be latent in either of two ways, owing, 1st. To the absence of all pain whatever. 2d. To pain being felt in some part remote from the thorax, and suggesting the existence of disease in some other quarter. This *second form* of latent pleurisy has hitherto not been noticed by writers; but I have met with several instances of it, and recently with three cases which were primary and uncomplicated. In all these the pain was referred to the iliac region of the same side, no pain being felt in the chest, at any part, upon a full inspiration, or when coughing, although it was excited in that remote situation. In most cases of latent pleurisy there are chilliness, thirst, heat of skin, especially in the trunk, dryness of the general surface; and, as effusion becomes copious, shortness of breathing, with more or less difficulty or oppression, upon the least exertion. This form of pleurisy often affects children and old persons; and in both classes of persons it is frequently associated with catarrh or influenza. Indeed, so often is this complication met with in these subjects, that a careful examination of the chest should be made in

all cases of severe catarrh or influenza affecting them.

51. v. Partial Pleurisy.—Circumscribed or partial pleurisy may occur *primarily* or *consecutively* of other diseases, but much more frequently in the latter than in the former state. Circumscribed or limited pleurisy may also be attended either with *adhesions* only, or with *effusion*, adhesions, however, of various extent also existing in the latter class of cases.—*A. The adhesive form of partial pleurisy* is very frequent, and is commonly consecutive of tubercular formations in the lung, of either of the forms of pneumonia, and of inflammatory irritation of any kind in the vicinity of the part of the pleura becoming thus affected. It is a very usual consequence of tubercular depositions, softened tubercles or cavities, when either approach to the surface of the lung, the pulmonary pleura then becoming inflamed, and throwing out lymph which agglutinates it to the opposite costal or diaphragmatic pleura, most frequently to the former at its upper regions. The pleuritic affection is in these cases often slight, but it is seldom latent to the close observer. It is generally indicated by more or less pain, uneasiness or tenderness in or over the part affected; by a feeling of constriction or tightness, by frequent superficial breathing, and by diminished motion of the ribs in that situation; somewhat increased dulness on percussion, increased pain or uneasiness upon stretching or exerting the adjoining muscles, and a greater intolerance of a strong percussion over the part than in any other place, are often, also, present. The pain is sometimes sharp, evanescent, and even so slight or brief in duration as hardly to be noticed or recollected. This form of partial pleurisy is often salutary in its effects, in respect of the tubercular malady, of which it is so generally a consequence, inasmuch as the adhesions between the opposite pleural surfaces prevent ulceration and perforation of the pulmonary pleura, and the escape of the tubercular matter into the pleural cavity. Although this state of the disease is sometimes latent, it is less frequently so than has been stated by some writers, it being rather overlooked, owing to the slightness or evanescence of the symptoms just mentioned.

52. *B. Partial pleurisy with effusion* is much less frequent than the foregoing.—(*a*) It is commonly a consequence of a more general state of the disease, in the course of which adhesions have taken place between the opposite surfaces in one part, and effusion or even suppuration in another. In some instances, the pleurisy attacks a person who has previously been the subject of this disease, and in whom adhesions of greater or less extent already exist; and this subsequent attack affects merely that portion of the pleura which is non-adherent; the adhesions limiting the extension of the inflammation, and bounding the liquid effusion, or purulent formation. Partial pleurisy, accompanied with liquid or puriform effusion, may occur in any situation; but its nature can seldom be ascertained with any degree of certainty during life.

53. (*b*) The above observation applies to *interlobular pleurisy*, or inflammation, and its consequences affecting the opposite surfaces of two corresponding lobes of the lungs. This particular form of partial pleurisy is rarely primary, but is generally consequent upon the more general state of the disease, or upon tubercles in the lungs or pneumonia. The *vomicæ*, so often said to have been found in the lungs, have very probably been puriform collections between the opposite pleural surfaces, circumscribed by adhesions, in this and the preceding states of partial pleurisy.

54. (*c*) The question has been put by M. Cruveilhier, whether or not a *costal pleurisy* can exist independently of a *pulmonary pleurisy*, or the latter exist without the former. Bichat believed that it could not, and contended that the inflammation always extended from the one surface to the other continuously, or without any interruption at the non-adherent parts. I am convinced, however, that this is not the case, unless in the asthenic or spreading form of the disease; but that the inflammation originating in either surface is followed by an exudation of lymph which acts as an irritant, when brought in contact with the opposite surface, and inflames this latter; and thus inflammation, or adhesion, or even effusion, is often developed in the opposite surfaces without the continuous extension of the morbid action over the intervening, non-adherent, or unaltered part of the membrane.

55. It has been supposed by some writers that inflammation of the pulmonary pleura is not attended by pain, and that pain is felt only or chiefly when the costal pleura is implicated. This opinion has been considered to derive much support from the different anatomical connexions of the two portions of this membrane. This distinction, however, is by no means determined; farther and more precise observation is required before an opinion can be given respecting it.

56. (*d*) *Costo-pulmonary pleurisy* may be attended by liquid, or sero-albuminous, or puriform effusion or collection, limited by adhesions to a smaller or larger space, as shown above (§ 52). The circumscribed purulent collections—the *empyema necessitatis* of various writers—sometimes met with, and that point externally, are of this kind.

57. *C. Mediastinal Pleurisy.*—This form of circumscribed pleurisy has been considered, as far as the subject admits of consideration, in the article Mediastinum. It is unnecessary, therefore, to add more at this place than to remark, that inflammation may originate in that portion of the pulmonary pleura in contact with the mediastinum, and extend to this latter, forming adhesions between them, and giving rise to liquid or puriform effusion, which may be bounded by these adhesions. In cases of considerable duration, the liquid collection may assume puriform and encysted appearances. The exact nature of these cases is seldom accurately ascertained during life; for they are most frequently secondary and complicated with pneumonia, or with tubercles in the lungs, or even with pericarditis. The symptoms of this state of the disease, as far as they are known, are the same as those stated in the article Mediastinum (§ 3, *et seq.*).

58. *D. Diaphragmatic pleuritis* is of frequent occurrence, especially in the course of inflammations of the liver and peritoneum, and even,

although much more seldom, of the liver and of the spleen.—(*a*) This form of pleurisy may be consequent upon either acute or chronic disease of these parts, especially upon the former. I have at another place (*see* Liver, § 41, *et seq.*) remarked upon the not unfrequent extension of inflammation from the liver to the diaphragm and diaphragmatic pleura, and even also to the costal and pulmonary pleura; and, although this occurrence is sometimes met with in connexion with abscess of the liver, it also not unfrequently takes place in the course of sero-hepatitis, or in cases of inflammation of the superior serous surface of the liver, and of partial peritonitis in the superior abdominal regions. I have met with several cases of acute sero-hepatitis in which the inflammation rapidly extended to the pleura, the disease consisting, during the greater part of its course, of hepatitis complicated with pleuritis.

59. It is very rare, however, unless in cases of this kind, that is, in those consequent upon inflammation of some one of the abdominal viscera, that pleurisy is limited to the diaphragmatic pleura; and even in those it soon extends, more or less, to the pulmonary or costal pleura of the same side as that on which the viscus first attacked is situated. This mode of extension is not, however, always observed; for, in a case at this moment attended by me, but which I did not see at its commencement, there are chronic hepatitis, with tenderness in the region of the liver, effusion into the peritoneal cavity, and pleuritic effusion into the left pleural cavity, the heart being pushed towards the right side of the chest.

60. (*b*) The *symptoms* of diaphragmatic pleuritis differ but little from those of the more usual states of pleurisy. Generally, however, when this portion of the pleura is more especially affected, there are acute pain, augmented by inspiration, by physical efforts, by vomiting, or even by the eructations of flatus, and seated at the base of the thorax on either side, or about the attachments of the diaphragm to the thoracic parietes; anxiety, difficulty of breathing, or orthopnœa, the patient being obliged to sit up, with the trunk of the body bent forward; an anxious and distressed expression of the features; sometimes nausea or vomiting, and singultus; and considerable symptomatic fever, occasionally with delirium. When effusion is considerable, or collections of seropuriform or purulent matter are present between the base of the lungs and the diaphragm, this latter is pressed downward, and considerable fulness, with dulness on percussion, is observed in the hypochondrium of the affected side, and thus the semblance of an enlarged liver or spleen may be occasioned. When the liquid collection is completely circumscribed between the base of the lungs and the diaphragm, the diagnosis is usually difficult. The antecedent symptoms, especially pain or stitch in the side, with symptomatic fever, ushered in by rigours, will indicate the nature of the disease. Complicated cases, however, may occur in which the diaphragmatic pleura is affected on the one side, and the peritoneum, or some infra-diaphragmatic viscus, on the other, and be attended by great difficulty of ascertaining the exact seat and extent of mischief; but a careful examination of the physical signs and the symptoms during the progress of the disease, and a due recollection of the fact that inflammations not unfrequently extend from one side of the diaphragm to the other, especially from the peritoneal to the pleural surface, will often aid the physician in his diagnosis. In some cases of diaphragmatic pleurisy of the right side, excessively acute pain along the margins of the right side; short, anxious respiration, jaundice, protrusion of the liver downward by the fluid effused between the diaphragm and lungs, and much symptomatic fever, were the most prominent symptoms.

61. vi. Double Pleurisy.—*a*. Pleurisy rarely attacks both sides of the chest at the same time and in a primary form; but instances of this double disease occasionally present themselves, especially in a secondary form, and consecutively of adynamic, or malignant, or of exanthematous fevers, of erysipelas, or of those states of constitution which have already been noticed as imparting an asthenic character to pleurisy, more particularly morbid states of the circulating fluids. In double pleurisy, both sides of the thorax are not always affected to an equal extent, nor are the inflammatory products always the same, in respect either of the effusion or of the more consistent exudation. One or other may be much more abundant in one side than in the other, and even be otherwise modified or different; and very generally the patient is carried off, either by asphyxia, or by the effect upon the powers of life occasioned by the extent of lesion, before effusion has taken place in both pleural cavities to a great amount, or before the false membranes which may have been exuded have presented any advancement towards organization.

62. *b*. The *symptoms* and *signs* of double pleurisy, in most instances, readily evince the extent of the disease. In some cases, however, there is difficulty in determining, 1st, the existence of pleurisy; and, 2d, its presence in both sides of the thorax. When effusion takes place, then the bronchial respiration, ægophony, and the obscurity of the sound, can leave no doubt as to the nature of the disease. The sound emitted on percussion is attended by greater difficulty, because the means of comparison are wanting. Pain is not always a certain symptom, as it may be wanting in either side, although the amount of disease may be even greatest in the side where it is not felt. Generally, however, the history of the case, the state of respiration, the positions of the patient, and the constitutional symptoms, viewed in connexion with the physical signs, will indicate the extent of the malady. This state of pleurisy is much more dangerous than the ordinary forms; indeed, the patient may be carried off by it, aided by some other associated complaint, before the more advanced lesions have supervened, and even before the amount of effusion or the character of the symptoms had admitted of the recognition of the full extent of the malady.

63. vii. Chronic Pleurisy.—Empyema.—Pleurisy assumes every grade of severity, of activity, and even of duration. It may be most acute, as respects the degree of suffering, and the rapidity of its progress; and it may be most latent in its character, and slow in its course, and in the progress of the suc-

cessive changes attending and consequent upon it. Between the extremes of these, the intermediate grades of morbid action and duration, and shades of character, are innumerable. *Chronicity*, therefore, in respect of pleurisy, is, perhaps, more of a conventional term than as regards almost any other malady. The *chronic state* of this disease is commonly consequent upon the acute, when this latter has been either neglected or improperly treated; but it is also sometimes primary, or rather the advanced or prolonged state of a pleurisy which has commenced in a latent and silent, perhaps also in a slight or sub-acute form, and has continued thus to advance until the amount of effusion has given rise to phenomena such as have been described above (§ 30, *et seq.*), and as could not be neglected any longer by the patient or overlooked by the physician. Chronic pleurisy may even be an *intercurrent* malady, or supervene secondarily in the course of some other disease, although not so frequent as acute pleurisy. Thus it may occur in the course of chronic disease of some contiguous viscus, as of the lungs, liver, spleen, peritoneum, stomach, &c., or of malignant affections of the mamma, or diseases of the skin, &c.; while the acute states of pleurisy most commonly occur in the course of malignant or adynamic, exanthematous, and other fevers, or of inflammation of adjoining organs. Chronic pleurisy may thus, as well as in other forms of succession, be *complicated* with some other disease; indeed, it frequently becomes thus associated from the very circumstances of its duration.

64. Chronic pleurisy, in the state of full development, is attended by great effusion of fluid; and to this condition, whether it be the consequence of a violent attack, or of a sub-acute, or of a latent state of the disease, the term *empyema* has been given, although the composition of the fluid effused is often very different from pus; it being more frequently serous, sero-albuminous, or sero-puriform, or sero-sanguineous, as will be more fully shown in the sequel.

65. Although I agree with Dr. Williams that the transition of the acute to the chronic state is so indefinite, and the symptoms of the recent disease sometimes have so little of an acute character, while that of a long duration occasionally manifests so much greater an intensity of irritation, that the terms acute and chronic would seem to be less applicable to pleurisy than to other inflammations, still I cannot consent that the distinction in question should be altogether set aside. I readily, however, subscribe to the circumstance that much of the difficulty connected with this distinction is to be ascribed to the anatomical relations of the pleura: this being a shut sac, it is liable to have its acute inflammations rendered chronic by the retention of the inflammatory products; and the chronic state is equally liable to be excited into an acute state by the irritating and distending influence of these products, more especially the fluid products. Still, differences in character or form, in connexion with duration, are very apparent in many cases; in the prevalence of high inflammatory fever, severe local suffering, and rapid progress in some; or in the absence of fever, or in the existence of hectic or remittent fever, with but little or slight local suffering or discomfort, and slow progress or long duration in others; in the sthenic character of vascular action and vital power in many; in the asthenic condition of both action and power in some; and in the varying grades of pain, of irritation, and of sympathetic disturbance in all. These differences can hardly be described in all their phases of existence as they are presented to our view in practice; but they require to be pointed out in such a way as will most remarkably fix our attention, and render them safe guides in devising our indications and means of cure.

66. *Effusion* being the characteristic condition of *chronic pleurisy*, as well as of the advanced state of the most frequent form of *acute pleurisy*, it follows that all that has been stated above with reference to the latter (§ 24, *et seq.*) is equally applicable to the former. The disease, whether denominated acute pleurisy with effusion, or chronic pleurisy with effusion, or empyema—or whether or not the liquid be purulent, or sero-albuminous, or of any other description hereafter to be noticed—is attended by the same local and physical phenomena and signs, however much the states of vascular action, of vital power, and of constitutional disturbance may differ, in each case, with its duration and progress. *Chronic effusion*, even to the extent of compressing the lung and displacing the mediastinum, and even the diaphragm, may exist without distressing constitutional symptoms, which may either have subsided, or, in fewer cases, never existed. Dr. Stokes truly remarks that, if we separate the *physical signs*, we find nothing characteristic in the general symptoms alone. Hectic may or may not be present; and no characters of the cough, expectoration, respiration, decubitus, or, with a single exception, the appearance of the patient, are sufficient to distinguish this from other diseases of the lung. This exception is the dilatation of the side and intercostal spaces. But if, in addition to the symptoms of pulmonary irritation and obstruction, as shown by cough, shortness of breathing, dyspnœa, increased by exertion, or by lying on the affected side, and by a sense of fulness and oppression referred to one side, which is often œdematous, the physical signs of fluid accumulation, compression, displacement, &c., be also present, we may safely diagnosticate the disease.

67. In certain cases the general symptoms are nearly wanting. Instances are not rare of persons with copious effusion of considerable duration to be without fever, pain, or local distress; to look tolerably well, and to have good appetites; to lie nearly equally well on either side, and even to pursue their usual occupations, when these are not laborious. The physical signs are hence of the utmost importance in chronic pleurisy; indeed, of greater value in this than in any other thoracic disease. Most cases of bronchitis, of pneumonia, and of phthisis can be, at least, recognised, as Dr. Stokes remarks, without these aids; but such is not the case with pleurisy; and it is fortunate that its physical signs are more simple, numerous, and striking than those of any other of the complicated diseases of the lung.

68. When chronic pleurisy is not accompanied by much fever or pain, the patient may not be obliged to keep his bed. He complains only

of shortness of breathing on exertion; and he often pursues his usual occupations. He merely believes himself indisposed, and considers that he is not the subject of serious disease, until the pallor and emaciation of his features, the general loss of strength and flesh, the coldness of the extremities, the short, suppressed cough, the frequent and short respiration, increased on the least exertion or mental emotion; the loss of appetite, the rapidity of his pulse, especially during evening exacerbations, of hectic; and the inability of lying on any other than the same side, attract his notice, and direct the attention of the physician he consults to the nature of his complaint. These symptoms having suggested the seat of the mischief, an examination of the chest readily discloses its nature and extent.

69. *B.* The *physical signs* of chronic pleurisy are those already described (§ 26, *et seq.*) as evincing extensive fluid accumulation in the pleural cavity; but they become, with several of the general symptoms, much modified by the duration of the effusion, and by the changes in the pleura and lung. The state of the liquid effusion also modifies the course and phenomena of the disease; and hence it is necessary to notice briefly those changes which thus influence the character of the malady. When pleurisy has continued for some days, alterations take place not only in the more consistent exudation, but also in the fluid effused. These alterations depend much upon the diathesis of the patient, and the states of vital power and vascular action; and although some of them may be inferred to be present by the symptoms and signs during life, yet others are, owing to their nature, incapable of being indicated until disclosed after death.

70. (*a*) In healthy, young, and robust persons, lymph of a highly organizable quality is thrown out upon the inflamed surface, of greater or less thickness, with a serous effusion; and this lymph, forming a layer, or false membrane, over the surface, although diminished by absorption, becomes more dense as it is organized, and thus restrains the expansion of the lung, and impedes the absorption of the accumulated serum. In cases where the membrane is less dense or thick, the expansion of the lung and the absorption of the fluid may proceed, especially when vital power is not defective, until ultimately the fluid is removed, and the lung acquires very nearly or altogether its natural expansion. In this case adhesions, cellular, partial, or otherwise, may form, and the functions of the lung not be materially impeded (see § 115).

71. (*b*) In other cases, by no means different from the above, or varying only in the states of vital power and vascular action, and generally of a less active inflammation and more prolonged duration, organization proceeds slowly, and the false membrane is of a more dense and rigid nature. Consequently, the lung is prevented from expanding, even although the fluid effused be partly or nearly altogether absorbed. In many cases, especially in those of considerable duration, the false membrane covering the lung shrinks or contracts in its superficial extent, in the manner stated when describing the changes consequent upon peritonitis, or like cicatrices after burns of the skin, and thus not merely prevents the expansion of the lung, but actually compresses this organ still more closely. In more chronic cases the membranes formed on the pleura assume a state of cartilaginous induration, or become more or less extensively ossified, or they may be cartilaginous in parts and ossified in others. These changes often coexist with the shrinking just noticed, and are to be ascribed in part, in some cases at least, to the irritation produced by the effused fluid on the surfaces enclosing it.

72. (*c*) In some cases, when the vital energy is insufficient to enable the inflamed surface to throw out a readily organizable lymph, the exuded matter assumes a curdy appearance, of greater or less thickness, almost solely albuminous, and presents much less of a fibrinous character than in the foregoing cases; and the fluid part of the exudation is turbid, or contains loose shreds or pieces of albumen (see § 116, 117). In some instances a false membrane of some density is found covering the inflamed surface, but it is imperfectly organized, or presents no traces of organization. In other cases, a coating of albumen, without adhesion or organization, covers the pleura, the fluid effusion being turbid, serous, or sero-albuminous, or otherwise changed or coloured, according as colouring particles of the blood may be exuded. This class of cases is more frequently of much shorter duration than the foregoing classes, are always asthenic, and are more closely allied to the acute asthenic form of the disease (§ 47), being more prolonged instances of that form.

73. (*d*) The albuminous or nutritive matter may be thrown out in a more diffused form with the serum; or the formative process, characterizing so frequently inflammations of serous surfaces, may be still less exerted, and a puriform, or sero-puriform fluid only be produced. It is probable that, in some instances, when the immediately preceding state (§ 72) of the disease is much prolonged, the sero-albuminous exudation may pass into a puriform or sero-puriform state. This purulent state of the effused fluid appears most frequently in the most chronic cases, but it also is sometimes observed in the most acute, and is that to which the term *empyema* is strictly applicable. It depends rather upon the state of vital power, or the diathesis of the patient, in connection, probably, with the condition of the blood, than upon the duration of the disease. Dr. Williams very justly remarks, respecting this state of the disease, that "the solid matter is thrown out in a disintegrated state, utterly insusceptible of organization, and diffused through the fluid in flakes or particles, forming a mixture more or less resembling pus, which is the fluid or empyema. Although in many instances this is the result of a more chronic form of pleurisy than that which forms lymph, and owes its persistence and tendency to increase to the want of vitality in its solid matter, yet we do meet with cases of empyema which arise from very acute forms of inflammation. In these instances the fluid is more strictly purulent, the solid matter being in the form of globules, like those of pus, and seems to be the result of what may be called a suppurating diathesis, in consequence of which all the albuminous products of

inflammation tend to assume a purulent character." It should be remarked, also, that the continued access of air will cause the inflamed pleura to secrete pus instead of coagulable lymph, this membrane being similarly influenced by this cause to other tissues. Whenever pleurisy is consequent upon perforation of the lung, the effused fluid is always purulent.

74. (*e*) The other lesions which are contingently associated with chronic pleurisy, especially the tuberculous, schirrous, encephaloid or fungoid, and melanotic, generally proceed from their respective constitutional taints: they will receive due consideration hereafter.

75. It is obvious that the above states, into which the lesions of chronic pleurisy may be divided, are not precisely defined in all cases; but that instances occur, owing to changes of vital power and vascular action in their course, in which intermediate conditions, or transitions from one state to another, may be found on close examination. The truth is, that in many instances, even after the acute action has subsided to the chronic state, the retained effusion, owing to the nature and combination of the several elements, may rekindle an acute or subacute state of action, or keep up a continued irritation, which cannot fail of producing a varied series of changes not only in the false membranes, but also in the pleura itself and the subjacent tissues; and that the effused fluid, as well as the surrounding structures, both natural and adventitious, will consequently undergo changes varied in numerous ways, although most frequently presenting the general features now pointed out, and those about to be more minutely described (§ 118, *et seq.*).

76. In some cases the condition of lesion, in respect both of the more consistent exudation and of the fluid accumulation, may be predicated during life from the indications of vital power and vascular action furnished by the patient. The *first* and *second* of these conditions (§ 70, 71) are generally attended by a more sthenic state or diathesis, by less failure of constitutional power, and a stronger grade of vital resistance. The *third* (§ 72) is accompanied with more marked asthenia; with greater depression of vital energy and resistance than the first and second; with more or less of a cachectic appearance, or of a morbid condition of the circulation. The *fourth* (§ 73) of these conditions, or that to which the term *empyema* is more strictly applicable, is generally attended by hectic of a marked character, by night perspirations, and often by various pulmonary symptoms in connexion with physical signs of accumulation of fluid in the plural cavity.

77. When we reflect upon the effects consequent upon the retention of the products of inflammation in the pleural sac; upon the constricting action of the organized false membranes on the lung; upon the irritation caused by the nature of the fluid effusion, and the consequent resuscitation of inflammatory action in acute or subacute states, extending more or less to the parenchyma of the lungs; upon the influence of constitutional diathesis and taint upon the states of vascular action and adventitious productions; and upon the numerous contingencies, intrinsic and extrinsic, moral and physical, to which the patient is exposed, we may readily infer that chronic pleuritis, if not soon remedied, must necessarily be followed by farther alterations, not only of the adventitious formations, and of the consistent and fluid deposits in the pleural cavity, but also of the lungs, bronchi, pericardium, and parietes of the chest. These successive alterations all tend to impede absorption, and thereby to perpetuate the disease; and are the most important lesions which *complicate* the advanced course of the more unfavourable cases of chronic pleurisy. Nevertheless, absorption does take place in many instances—sometimes even in prolonged cases, especially when vital power and resistance are tolerably maintained, and when the consecutive lesions, or *complications*, about to be noticed are not developed.

78. *C. Signs of Absorption of the Effusion.*—(*a*) Many of the cases of acute and subacute pleurisy recover without contraction of the side or depression of the shoulder, such as will be noticed hereafter; but in these cases the effusion is more or less readily absorbed. It is, however, comparatively rare for the fluid to be removed, in the more chronic cases, without these changes in the appearance of the affected side being observed. When the lung is bound down or constricted by the false membranes, as stated above (§ 71), or when it is so condensed by long-continued pressure, or by the extension of inflammation to its parenchyma, as no longer to be capable of expansion, the removal of the fluid accumulation by absorption necessarily occasions, owing to the atmospheric pressure, more or less contraction of the affected side, which, instead of being enlarged beyond the size of the healthy side, now gradually becomes smaller—sometimes very remarkably smaller, than that side. The contraction appears at first in the upper part of the chest; the shoulder being depressed, and, with the whole side, much more fixed than the sound side, which presents the full development and active motions of respiration. As the diseased side contracts, the ribs approach closer together, and sink lower; the scapula is more prominent, and nearer the spine; and the sternum and spinal column are somewhat curved, so as to be concave on this side. While the upper parietes of the diseased side are thus pressed inward, the lower walls are similarly affected; the diaphragm is carried upward, and with it the liver, or the stomach and spleen, according as either side is affected. In cases where the absorption has proceeded far, or has taken place long previously, more especially in children and young persons, the healthy lung becomes so expanded or developed from its augmented function as to press the mediastinum over into the affected side, and thus even to prevent a still greater contraction of the side from occurring. Cases are not very rarely seen in which the heart has been thus pushed either to the right side, or drawn upward to the left, owing to the two causes of absorption of the effusion in the side toward which the heart and mediastinum are drawn, and of expansion of the lung in the sound side. In cases of this kind, the displacement, instead of being the result of liquid effusion, or of a collection of air or gas pushing these parts to the sound side, is caused by the removal of fluid from the affected side, in the manner now pointed out.

In a few instances, as remarked by Dr. Stokes, the contraction is confined chiefly to the lower portion of the side, the shoulder not being materially depressed. In those instances, occurring in young persons, in which the sound lung becomes much expanded, the deformity often is much diminished in process of time.

79. M. Laennec has insisted strongly on this termination being most frequent after what he terms the *hæmorrhagic pleurisy*, or that state of acute pleurisy in which the fluid effusion is very great, and more or less tinged with blood-globules, and which often becomes chronic owing to the slow removal of the fluid. Although contraction of the chest is most apt to accompany the cure of the most severe cases, or those in which the effusion has been the greatest or most prolonged, yet it is by no means confined, as Laennec supposed, to those cases which he denominated hæmorrhagic, or even most frequently consequent upon these; for, as Dr. Forbes has remarked, it is a common consequence of the removal of all fluid effusions of considerable duration, and of purulent collections in the pleural cavity; "and, if other evidence were wanting, we have it in the analogous contraction in chronic pneumonia and phthisis."

80. In some instances the contraction consists chiefly of a flattening of the anterior portion of the side, causing more deformity than diminution of size. In others, the affected side approaches somewhat to a triangular form, "the base of the triangle corresponding to the mesial line, and the apex to the centres of the ribs." One of the first signs of absorption with contraction is the increased prominence of the inferior angle of the scapula. Dr. Stokes thinks it likely that the paralysis of the intercostals and diaphragm, which he believes to accompany pleurisy, has an immediate effect in producing the subsequent contraction, by preventing the expansion of the side.

81. The condition of the side of the chest changing thus from that of dilatation, consequent upon the effusion, to that of contraction caused by the removal of the fluid, it may be supposed that the transition from the one to the other will not be indicated by the form of the chest; and this is really the case in some instances, although in the majority the transition is not uniform, but partial. More frequently the contraction commences at the upper part of the thorax before the dilatation and displacement have entirely disappeared at the lower. An irregularity of the shape of the affected side is hence often observed during the removal of the effusion by absorption, the upper parts being unusually contracted or depressed, while the lower are more or less bulged or dilated. This appearance assists in the diagnosis between consolidation of the lung and progressive absorption of a pleuritic effusion, for which this latter may be mistaken.

82. But the effusion into the pleural cavity may not be to the extent of filling this cavity; it may be partial only, or limited by adhesions and false membranes, as above described (§ 52). In these cases of partial adhesions, the walls of the chest cannot so contract as to accommodate themselves to the vacuities caused by the removal of the fluid. Sometimes slight or irregular contractions may take place; but the spaces are chiefly occupied by a partial rising of the diaphragm, and expansion of the healthy lung on both sides; and most frequently a portion of the more consistent or albuminous contents of the effused fluid still remain, presenting a curdy or semi-solid state, which is probably ultimately removed when the patient permanently recovers.

83. *b. The auscultatory signs* furnished by a side contracting after chronic pleurisy are of importance, inasmuch as during the progress of the contraction the disease may be mistaken for chronic pneumonia, or consolidation of the lung, or for tubercular diseases of this organ, or even for enlargement of the liver. In many cases, especially when the effusion has been copious and of long duration, the sounds of respiration and percussion continue permanently imperfect, even although the fluid may be completely removed, and they are universally more or less impaired for months after the attack. They thus correspond with the diminished motion of the affected side, and are owing to the same lesions. Dr. Williams correctly states that an improvement is generally indicated first in the upper part of the chest, and near the spine. With the return of a weak respiratory murmur, and slight resonance on percussion, some degree of vocal resonance may also accompany the removal of the fluid in the upper parts of the chest, "amounting to loud bronchophony, often accompanied with a remarkable *buzz*; in other parts being merely the diffused vocal fremitus, according to the size of the bronchial tubes, and the degree and permanence of their compression." In some cases of this kind some of the physical signs may mislead, if attention be not paid to all these signs, and to the history of the case; for, as remarked by Dr. Stokes and Dr. Williams, if at the first time we see a patient with the above signs, and he happen to have bronchitis, we may be induced to believe that the resonance of the voice and the dulness are caused by consolidation from recent inflammation of the lung, or from tubercles; but this error will be prevented by attending to the history of the case and the appearances of contraction. The dulness on percussion of the contracting side is owing both to the falling inward of the thoracic parietes and to the absence of air in the compressed lung. The physical conditions of the lung and of the wall of the chest are much changed in this state of the disease; for both, especially the former, owing to the loss of their resiliency—the lung being constricted by false membranes, and compressed by the effusion, and thereby in great measure deprived of air; and the parietes of the thorax being insufficiently antagonized against the pressure from without by the much-diminished supply of air to the lung—are incapable of furnishing not only the usual sounds on percussion, but also the true indications of their existing states, unless by a strong pressure of the fingers, which are the media of percussion against the walls of the chest, and by varying the force, direction, &c., of the stroke.

84. Recovery from chronic pleurisy, with contraction of the chest, is more or less complete according to the reduction that has been made in the size and functions of the lung by the previous lesions. The recovery is rarely

so complete in persons advanced in life as in the young. In children, placed otherwise in favourable circumstances, and in young persons, recovery is often not only complete, but little or no inconvenience is caused by the contraction, which sometimes diminishes, especially in growing persons, owing to the increased development of the healthy lung. Some individuals, who have their sides contracted from the state of the disease, have continued to enjoy good health, and to pursue active occupations. Laennec has alluded to a distinguished surgeon in Paris who had his side remarkably contracted by pleurisy in his youth, and yet enjoyed excellent health, and was in the habit of lecturing twice a day without inconvenience. In most instances thus occurring in young subjects the contraction is not excessive, and the respiratory murmur is not altogether abolished. But in a greater number of cases, particularly those occurring in advanced life, contraction of the chest occasions such an habitual shortness of breath and tendency to palpitation as to incapacitate the subject of it from active exertion. Persons thus circumstanced also experience distressing dyspnœa, and otherwise suffer most severely from slight bronchial attacks, from catarrh, and febrile affections. Dr. Williams very justly remarks, that before the system becomes accommodated to the abridgment of respiration which this lesion produces, and even afterward, under unfavourable circumstances, there is an enfeebled or cachectic state of the whole frame, in which various trains of disorder may arise; and unless care be taken to counteract them by the means most favourable to the general health, scrofulous or dropsical disorders may be engendered, and develop new mischief in the respiratory organs or elsewhere. Although, therefore, contraction of the side of the chest may be viewed as a mode in which pleurisy may be cured, "it is one of the least favourable kind, and liable to many detracting circumstances."

85. *D. Empyema.*—In those cases in which the effusion is not removed by absorption, or in which the morbid secretion or effusion equals or preponderates over absorption, the accumulated fluid is productive of changes ultimately of a fatal tendency, if it be not evacuated either by a spontaneous perforation of the pleura, or by an operation. The persistence and character of the accumulated fluid are to be ascribed rather to the continued inflammation and change of structure of the pleura than to any other cause. The nature of the matter effused, its purulent character more especially, also favours the accumulation or impedes absorption. Something, also, may be imputed to a congested state of the lung, to tubercular infiltration, or to consolidation of its structure. When the circulation through the heart or blood-vessels is obstructed, the cause of increasing fluid accumulation is more manifest.

86. *a. The signs and symptoms of empyema* are nearly the same as those already described in connexion with very copious liquid effusion into the pleural cavity (§ 26, *et seq.*). In this, however, the more chronic state of disease, the accumulation of fluid, proceeding more slowly, generally is greater, and is attended by a more marked displacement of the walls of the chest, and of the viscera more immediately adjoining them. Although the more urgent symptoms have in great measure subsided, particularly fever, dyspnœa, and pain, yet the enlargement of the side, and the displacement of the parietes, are often the more remarkable. The slow increase of the accumulation, the prolonged pressure, and, probably, as Dr. Stokes contends, the paralyzed state of the muscles bounding the effusion, favours the greater amount of fluid collection in this class of cases than in most others. The duration of the disease, the side which is affected (more frequently the left), the nature of the associations or complications, and the temperament and diathesis of the patient, modify both the extent and the phenomena of the accumulation, more especially the extent of enlargement of the side and visceral displacement. There is no certain indication usually furnished of the purulent nature of the fluid. When rigours or chills recur, with hectic, a soft, open pulse, perspirations, or even when these last are very prominent, there is great probability of the fluid being purulent; but these symptoms may be either but slight or nearly wanting. Protrusion of the intercostal muscles is considered by Dr. Stokes and Dr. H. Roe as more especially diagnostic of a purulent state of the secretion.

87. *b.* When the fluid is purulent, *ulceration* and *perforation* may ultimately attack the pleura at some point, and permit the fluid to be evacuated in a direction, according to the seat of the ulceration—either through the lungs, the walls of the chest, or the diaphragm; causing parts through which the evacuation takes place to be involved and more or less affected. Generally, the perforation of the pleura is consequent upon excavations in the layer of organized or semi-organized lymph coating this membrane; and sometimes death occurs before the perforation has become complete, or even proceeded farther than this false membrane. When, however, the pleura is perforated, the structures external to the ulcerated point in the pleura also become inflamed and ulcerated, and the accumulated matter makes its way in the direction of the ulceration, often burrowing between muscles or tendons, and even causing caries of the adjoining bones, as the vertebræ, ribs, or sternum.

88. Laennec and Hasse considered the perforation of the pulmonary pleura and discharge of the matter of empyema by the lungs and bronchi of more frequent occurrence than perforation of the walls of the chest. Dr. Williams doubts this, according to his own experience; and I think with good reason, as regards the whole parietes of the chest—costal and diaphragmatic. When the matter is discharged by ulceration through the lungs and bronchi, there is generally a violent fit of coughing, resembling or accompanied with vomiting, and attended by a copious expectoration or evacuation of it; the efforts, together with the quantity discharged, threatening suffocation; but remarkable alleviation of all the symptoms, and diminution of the evidence of dilatation and displacement, are the results. Dr. Townsend describes the ulceration through the lungs and bronchi, in these cases, as being preceded by the formation of a gangrenous eschar, which is detached, the fistulous passage being lined with a false membrane, which prevents the matter

from infiltrating the substance of the lung, and conducts it to the air-tubes (*see* § 125).

89. When the ulceration of the pleura commences, and proceeds in a situation favouring the pointing of the matter externally, a soft fluctuating swelling is felt at some part of the chest: and it may generally be presumed to communicate with the pleural cavity by its becoming tenser during expiration, and softer during inspiration, or by a sort of fluctuation caused by coughing. Dr. Williams remarks, what I have also seen in several instances, especially in children, that the matter not uncommonly burrows under and between the muscles and integuments of the chest, and points at several places, and at a distance from the perforation of the pleura. He has seen abscesses connected with empyema point in three cases under the pectoral muscle, once in the right hypochondriac region, and once close to the spine. That in the hypochondriac region had been mistaken for an abscess of the liver: in this case it was found, after death, that there were three perforations of both intercostal muscles and diaphragm; and between the layers of the latter the matter passed to the margins of the ribs, and there spread under the integuments, communicating with the other perforation between the ribs. In a case of empyema in the son of a medical friend, aged about six years, the matter was discharged near the margins of the right false ribs, and the boy recovered, and is now well, at the age of fifteen.

90. The superficial abscesses consequent upon perforation of the pleura are sometimes tender and painful; but they are occasionally also neither the one nor the other. They are generally slow in their progress to the formation of an external opening; usually spreading between the muscles and integuments, and causing a diffused or puffy tumour. When an opening is at last formed, there is a more or less copious discharge of matter, that recurs from time to time, especially during a forced expiration, or during coughing. "Sometimes air is drawn in through the orifice during full inspirations, and the next jets of matter issue with greater force, occasionally mixed with bubbles of air." After air is admitted into the diseased cavity, the pus, which was at first inodorous, generally becomes in a few days more and more fetid, and exhales the odour of sulphureted hydrogen. With this change in the discharge, or, rather, as a cause of this change, the constitutional symptoms assume an asthenic and irritative character. The pulse is much more accelerated; is quick and irritable; soft, open, and sharp; and the skin is alternately hot or burning, and bathed in a colliquative perspiration. The bowels become irritable; and general depression and asthenia, with irritative fever and rapid emaciation, soon carry off the patient.

91. The matter of empyema may be discharged by a fistulous opening, either uninterruptedly or at intervals, with more or less temporary relief. The recurring discharge may exist for weeks, often for months, and, in rarer instances, even for years; the patient occasionally recovering, but much more frequently sinking from the extent and nature of the disease. Recovery is oftener seen in the young than in persons even moderately far advanced in life · and when it is likely to take place, the discharge soon becomes less, and either does not present, or loses, its fetid character. The external opening closes, and the side becomes contracted, as already described (§ 78, *et seq.*), respiration partially returning in some portions of the chest.

92. *D. The terminations of chronic pleurisy* may be readily conceived from what has been already stated. The *duration* of this state of the disease varies from six weeks to a year, or even much more, when it terminates either in *recovery* or in *death*.—(*a*) *Recovery* often takes place after a gradual *absorption* of the effused fluid and of the albuminous exudations, or after the organization of the latter into false membranes. This mode of termination is evinced by the signs mentioned above, and by the depression and contraction of the affected side (§ 78).—(*b*) *Recovery* much more rarely occurs by the evacuation of the accumulated fluid through a *perforation of the pleura*, and a fistulous opening, either in the lungs and bronchi, or in the thoracic parietes (§ 88).—(*c*) *Death* is frequently caused, 1st. By the general exhaustion and hectic attending the disease, especially when the accumulated fluid is puriform, or when the substance of the lungs is consolidated or tuberculous: in these cases the patient sinks in the same manner as in tubercular consumption; 2d. By the sudden asphyxia of the patient: in these, sudden attacks of dyspnœa, almost amounting to suffocation, sometimes are complained of, at intervals, before the fatal seizure; these attacks often occur during the night, and may return almost nightly. Death may take place very nearly as suddenly as from disease of the heart, and may be thus mistaken for death from this cause, if the history of the disease be not known or ascertained.

93. III. Complications of Pleurisy.—*Pleurisy*, in either of the states described above, is very frequently a *primary* and *simple* disease. But it is also often *associated* with inflammation of an adjoining tissue or organ, or with some other lesion or malady. In this *complicated state*, it may be either the *primary* or the *secondary* disease; the exact condition and succession being of importance in respect both of the prognosis and of the treatment. I will, therefore, notice some of the more frequent complications of it observed in practice; and, in some instances, a mere notice is all that is necessary, as the suggestion of the associations which the disease so often presents will put the physician on his guard, when he will not fail of detecting it.—*a*. Pleurisy in any form, but more especially in the acute, is often associated with *inflammation of the substance of the lung*, forming *pleuro-pneumonia*, described in the article Lungs (§ 73–75), or *pleuro-pneumonitis*, *peripneumonia*, or *peripneumony*, of various writers. It is unnecessary for me to notice this complication farther at this place, than to add that the inflammation, in these cases, most commonly assumes a sthenic character, although the asthenic state is occasionally also met with; and that, although both diseases, or, rather, the inflammation of the two different structures, may be coetaneous as well as coexistent, yet the pleuritic is more frequently consecutive of the pulmonic affection than the pulmonic is of the pleuritic. This may be owing, in great part, to

the nature of the tissues, and of the connexion existing between them; but it is more probably owing to the general tendency of inflammations of parenchymatous organs to extend to the periphery.

94. *b.* Pleurisy, either in a simple form, or associated with pneumonia or with bronchitis, is one of the most important complications of *exanthematous* and *continued fevers*. When it is the complication or associated local affection in these constitutional maladies, it is always acute, unless when it appears in the course of convalescence from either of them; and it presents the same characters or diathesis, in respect of vascular action and vital power, as these possess; but the *asthenic*, in its various grades, is the most common, especially if it supervene at an advanced period of the fever, when the vital energy is depressed or exhausted, and when the circulating fluids are morbid or contaminated. Whenever the breathing is very short and frequent, with or without cough or pain in the side or chest, in these diseases, then this complication should be suspected, and a careful examination be immediately instituted, as the progress of the local mischief is generally rapid when it occurs in the course either of these or other constitutional maladies.

95. *c.* Pleurisy, generally of an adhesive form, and of chronic duration, very frequently accompanies *tubercular consumption* and chronic *tubercular pneumonia*. This pleurisy is generally the consequence of the irritation or chronic inflammatory action occasioned by the tubercular deposites in the lungs, especially when these exist near the surface, or when the tubercles soften in that situation, and are followed by cavities. In these cases the pulmonary pleura becomes implicated in the inflammatory action in the immediate vicinity, throws out lymph on its free surface, which excites a corresponding morbid action in the opposite part of the costal pleura, and forms close and firm adhesions between the lung and walls of the chest. This state of chronic or subacute pleurisy is most frequently observed near the summits of the lungs or upper regions of the thorax; is most commonly attended by adhesions, without fluid effusion; or, if such effusion occur, it is soon absorbed (*see* § 120). In some cases, however, tubercles soften and cavities form near the surface of the lung, and perforate the pulmonary pleura at the nearest point to them, without giving rise to adhesion to the opposite surface. In these, fluid effusion often takes place before the perforation is completed, and air passes into the pleural cavity, giving rise to the lesion denominated *pneumathorax*, which is fully considered in another place. The association of pleurisy with tubercular consumption is more fully considered in the article on this latter malady.

96. *d* Pleurisy is sometimes complicated with *pericarditis*. Generally the pericarditis is of the dry form, in which it has been remarked in several instances by Dr. Stokes. In two cases, to which I was called shortly before death, the previous history of which was not precise, but which were considered and treated as very acute cases of pleuro-pneumonia, the *post-mortem* examination disclosed the association of pleurisy with pneumonia and pericarditis. In both these cases there were considerable effusion, with shreds and pieces of lymph, into the left pleural cavity and pericardium, the diaphragmatic pleura being much affected. Dr. Stokes remarks, that where the pericarditis is of the dry form, the symptoms are not so violent as in that with effusion. He has observed this complication in cases of acute pleuritis, and in two instances of very chronic empyema. In the latter cases, the usual symptoms of pericarditis were altogether wanting, and no new suffering marked the invasion of the disease, which was discovered only by auscultation. The observations of M. Broussais apply chiefly to cases of this complication, with copious effusion into the pericardium, in which there are generally pains in the præcordia, with great anxiety and want of sleep. The patient sits bending forward, with his head resting on his knees; and yet, notwithstanding great concentration of the pulse, there is a tendency to fainting, and almost complete absence of fever. (*Traité des Phlegmasiæ Chroniques*, t. i.)

97. *e.* Although pleurisy is more frequently *caused by*, than *associated with*, *acute rheumatism*, still this complication is occasionally observed, the still farther complication with endocarditis or pericarditis being also met with in rare instances. This very complicated state of disease has been seen by me in children between eight and thirteen years of age, in three cases, in all of which it was recognised during life, and ascertained by inspection after death.

98. *f.* The complication of *hepatitis*, especially of inflammation of the convex surface of the liver, with pleurisy, is by no means infrequent, and supervenes chiefly in the course of the acute form of hepatitis. It occurs also in the chronic form, especially when an abscess of the liver is passing through the diaphragm, either into the pleural cavity, or into the lungs and bronchi, adhesions having been formed between the opposite surfaces of the pleura. This form of the complication is noticed in the article on the diseases of the Liver (§ 141–145); but I have seen cases of chronic hepatitis, not connected with abscess, that have been associated with empyema of the left side, the heart being pushed over towards the right side. I am at this time attending a female in Brook-street, aged between thirty and forty, who, according to the history of the case furnished me, appears to have been attacked by subacute hepatitis, attended by suppression of the menses, and followed by ascites, and by chronic pleurisy of the left side, with effusion, displacement of the heart, and dilatation of the thoracic parietes. I was recently requested, by Mr. Sims, a surgeon who had practiced in India during many years, to see a lady, aged about fifty, who was the subject of a most acute attack of hepatitis, to which rapidly succeeded dry pleuritis and pneumonia of the right side. In this very remarkable case, the symptoms and signs of hepatitis, of diaphragmitis, of diaphragmatic pleurisy, and of pneumonia with rusty expectorations, were distinctly recognised by Mr. Sims and myself. The patient recovered, and is now quite well.

99. *g.* Pleurisy may also be consecutive of, and complicated with, *peritonitis*, especially partial peritonitis of either of the superior abdominal regions. I have seen several instances of acute asthenic pleurisy, with abundant

sero-albuminous or sero-sanguineous effusion, complicating the several varieties of puerperal fever, and puerperal peritonitis and phlebitis; but in these complications the pleurisy was generally latent, death having taken place before obvious dilatation of the side or displacement of organs occurred. Indeed, in most of these cases, the pleuritic complication was double, although the fluid effusion and other lesions were much greater in one side than in the other, the amount of effusion in either side not being so great as to compress the lung in a remarkable manner.

100. I was lately called to a gentleman who had just arrived from the Azores with ascites, consequent upon repeated attacks of *peritonitis*; pleurisy, with effusion, having also supervened, and proved the more immediate cause of death. Upon examination, the appearances described in the article Peritoneum (§ 88, *et seq.*) were found, the adhesions being numerous, very long and thick, and the serous effusion very abundant. Some of these adhesions were round, as large as the first or second finger, with serous or polished surfaces, and formed cylinders, the external layers of which were organized and dense, and two or three lines in thickness, the interiors being loose and cellular, yet containing very much fatty matter, or, rather, consisting almost entirely of adipose tissue. A turbid serum was found in considerable quantity in the left thoracic cavity, in smaller quantity in the right, and adhesions, cylindrical or nearly so, stretched through the effused fluid, from the pulmonary to the diaphragmatic and costal pleura, in several places, and presented similar appearances to those in the peritoneal cavity; the thicker and the more cylindrical adhesions having organized serous surfaces, and cellulo-adipose centres; but the adipose matter was not so abundant in them as in the peritoneal adhesions.

101. *h.* In most of the complications above mentioned, the pleuritic inflammation is secondary, or consecutive of that with which it is complicated, unless in some cases of pericarditis. But in the course of many cases of chronic pleurisy, or empyema, complications may occur, and render still more dangerous, or even fatal, this already dangerous disease. This is more particularly the case when the fluid accumulation in the pleural cavity is of a purulent kind. In these, especially, various alterations take place in the surrounding structures, caused both by the nature of the accumulated fluid and by the mechanical influence of it. The substance of the lungs, the bronchi, the pericardium, and the mediastinum are either more or less implicated by the early stages of the pleuritic inflammation, or are consecutively irritated, inflamed, or otherwise changed by the nature and quantity of the effusion. Consolidation or atrophy of the lung often results; chronic pericarditis, with adhesions to the heart, sometimes takes place; the bronchi undergo various changes, and are often inflamed; the vessels of the lungs are altered, pulmonary phlebitis even occasionally supervening; and the vertebræ, or even the ribs, sometimes becoming carious. In addition to these effects, the actions of the heart and large vessels are impeded or disordered; while the blood becomes morbid, owing to the greatly impaired function of the lungs, and all the vital actions consequently languish.

102. IV. Pleurisy in the dark Races.—Pleurisy is very often met with in the negro and other dark races, particularly when they pass into high latitudes and cold regions; and in these circumstances it is very frequently associated with pneumonia, tubercular consumption, bronchitis, &c. *Acute pleurisy* in these races is frequently latent, most commonly presents asthenic characters, and is generally attended by copious serous, sero-sanguineous, or puriform effusion. Hence, unless the shortness of breathing, acceleration of pulse, short cough, and debility, with rapid exhaustion after slight exertion, usually attending the early stages of the disease in these varieties of the species, attract due attention, acute pleurisy will rapidly pass to its ultimate period, or may terminate fatally before its existence is ascertained. *Chronic pleurisy* is also frequent in these races, especially when they migrate to colder than their native climates. It often then assumes the purulent form, and is generally complicated with pulmonary tubercles. Pleurisy, both in acute and chronic states, frequently with effusion in the former state, and often with adhesions in the latter, is not an unusual complication of pulmonary tubercles in the dark races, especially after change of climate and exposure to cold, and is very commonly either latent or masked by the symptoms caused by the bronchitic complication, which is also frequently present.

103. V. Pleurisy in Infants and Children.—Pleurisy is met with in children of all *ages*; but it is most frequently seen, especially in an uncomplicated form, in children upward of five years of age. Before that epoch, it is rarely unassociated with pneumonia, and even, also, with bronchitis, pleuro-pneumonia being the most common state of disease. In children, as well as in adults, pleurisy is much more frequent in male than in female children. In this class of subjects it is frequently consecutive of pneumonia, and of eruptive fevers, either as a complication of those fevers, or as a sequela of them during some period of convalescence. Indeed, there is a remarkable disposition to the supervention of pleurisy, or of pleuro-pneumonia, during the whole period of convalescence from these fevers, more especially until the healthy functions of the skin are entirely restored. In other respects the *causes* of the disease in children are the same as those of adults; but, as shown when remarking on the prevalence of *pneumonia in children* (*see* Lungs, *Inflammations of*, § 122, *et seq.*), these causes act more injuriously, and their effects, whether in the form of pneumonia, of pleurisy, or of pleuro-pneumonia, are the more to be dreaded the younger the child which becomes the subject of them.

34. Pleurisy in children is most frequently single, as in adults. MM. Rilliet and Barthez state that, in the uncomplicated state, pleurisy is somewhat more frequent in the right than in the left side, while the complicated states occur more frequently in the left. This, however, does not agree with my experience; as I have found, in children as well as in adults, pleurisy in every form more frequent in the left than in the right side of the chest. As to

the products of inflammation of the pleura, false membranes, and serum more or less turbid, are most commonly observed in this class of patients, and the false membranes are most extensive and most generally found in the pulmonary pleura, and least abundant and frequent on the diaphragmatic pleura.

105. The accession of pleurisy is not always attended by rigours or chills, especially in young children—never in infants; and the *decubitus* in them especially is not much different from the usual. Sometimes decubitus on the back, with the shoulders raised, is preferred. In young children and infants especially, when associated with pneumonia, as pleurisy usually is, little or no fluid accumulates in the pleural cavity, although lymph is thrown out. The infant is restless, cries constantly, especially when moved or held erect; the skin is hot and dry; and the rubbing or creaking sound is heard on auscultation, the respiratory movements of the affected side being diminished. During the acute or early stage of the disease, in older children effusion, although abundant, seldom causes dilatation of the side: this symptom is rarely observed until the disease has become chronic, and then it is often remarkable and attended by pallor, enervation, debility, night perspirations, and loss of appetite. If the fluid be not absorbed or evacuated by an operation, death ensues, after one, two, or more months, the patient being in a state of complete marasmus. In the case of a young relative of my own, pleurisy, followed by empyema of the right side, occurred at the age of eight years, and the matter was evacuated externally by a fistulous opening, as described above (§ 99). He perfectly recovered; and the functions of the lung and the size of the side are now natural.

106. The *complications* of pleurisy are most to be dreaded in children; more especially when pleurisy occurs in the course of eruptive fevers, or of pneumonia or hooping-cough. In very young children, and in infants, this disease, whether simple or complicated, and more particularly when associated with pneumonia or bronchitis, or when developed in the course of hooping-cough, is very frequently fatal; and in infants it may terminate fatally, by causing suffocation in twenty-four hours. In older children, especially when uncomplicated, pleurisy, even in the more acute forms, is much more disposed to assume a chronic form than in the very young, in whom the more prolonged states of the disease are rarely seen.

107. VI. The State of the Blood in Pleurisy has recently received attention, but more as regards its chemical constitution than as respects its sensible appearances. Formerly, and with much better reason, these appearances attracted the chief, and indeed no small attention; for they furnish very important information as to the states of vital power and of vascular action characterizing the disease at the time when the blood is abstracted; and they moreover aid the physician in forming his diagnosis—still more in giving his prognosis—but most of all in determining his indications of cure, and in selecting the means of fulfilling them. Yet this important source of information is neglected, and the particular mode of studying the conditions of the blood in disease that actually furnishes the smallest amount of useful information to the practical physician is that which now attracts attention, although this very small amount cannot possibly be ascertained by the practitioner at the only time when it can prove in any way advantageous, while it causes the neglect of that knowledge which instantly furnishes the most important pathological and therapeutical indications.

108. *A.* The *appearances* of the blood, especially of the coagulum, vary remarkably in pleurisy, according to the states of vital power and vascular action.—*a.* In the *sthenic acute form* of the disease, the blood taken from a vein generally presents the buffy coat and a firm coagulum, the quantity of fibrin being generally about double the proportion observed in health. If the first bleeding has been early in the disease, the blood will generally present a firm and rather large coagulum, but frequently be neither cupped nor buffed, or but slightly so, although a second venesection, performed only a few hours afterward, will present these appearances in a high degree, a third depletion also presenting them, but in slighter grades. However, nothing can with certainty be affirmed as to the effects of a second or third depletion, as much will depend upon the quantity of blood taken away relatively to vascular fulness and action, and to the powers of the constitution; but commonly the proportion of the coagulum to the serum, or of blood-corpuscles becomes diminished, while the fibrin may be increased in the second blood-letting, but diminished in a third and fourth. In these cases, as well as in pneumonia and acute rheumatism, the quantity of fibrin is generally great in proportion to the degree of fever, pain, and sthenic action, while the blood-corpuscles, or hæmato-globulin, is diminished with the quantity of blood taken away. In fat persons, especially, the serum often assumes a whitish or milkly hue after repeated venesection, owing to the fat absorbed and conveyed into the blood. (*See art.* Blood, § 84, 96–103.)

109. *b.* In the *asthenic*, *cachectic*, and *latent states*, as well as in most instances of chronic pleurisy, the appearances of the blood are still more various than in the sthenic form; but in many instances they furnish important indications of cure. When vital depression is very remarkable, and vascular tone impaired or exhausted, the coagulum is either soft or the blood coagulates imperfectly, although the quantity of fibrin may be greater than in health; and a large soft coagulum is often imperfectly separated from the serum. In many of these cases the blood presents much of the appearance described in the article Blood (§ 94); but I have so rarely seen blood taken from a vein in these states of the disease, that I am unable to add more from my own observation, as to the appearances of the blood in these circumstances.

110. *B. Analyses* of the blood in pleurisy have been made by Andral and Gavarret, who found that the quantity of fibrin was increased to very much more than double the natural quantity; and that the increase was greatest in the most acute and most febrile and painful cases, and was the least in the chronic and non-febrile. Becquerel and Rodier analyzed the blood of five men attacked with acute pleurisy, and found the fibrin much more than double the healthy proportion, while the albumen and

blood-corpuscles were somewhat diminished; but the results of the observations of the physicians above mentioned are in no way precise, nor are the changes very remarkable, excepting only as respects the quantity of fibrin; the proportions of the several constituents of the blood depending much upon habit of body, sex, and constitution of the patient; upon the state, grade, and form of the disease; upon the states of febrile action and vital power; upon the stage of the malady, and the quantity of blood previously abstracted. Let the candid and practical reader peruse the accounts of numerous analysis of the blood made by German and French chemists and pathologists, especially those made with a view of showing the composition of it in pneumonia, pleurisy, rheumatism, erysipelas, &c., and he will find, according to the summaries of these analyses given in Simon's Animal Chemistry applied to Physiology and Pathology, with the additions by Dr. Day, the very slight differences, or even the sameness, of the results, as regards these and some other diseases. Having obtained the full amount of knowledge he possibly can derive from these sources, let him next endeavour to apply it to practical purposes; and if he can do so, with only one tenth of the advantage which may be derived from attention paid to, and an acquaintance with, the sensible appearances and properties of the blood, he will be much more fortunate than I can credit.

111. It is very justly remarked by Vogel, that it is very difficult—indeed impossible—to draw any certain conclusions from the statements of the above-mentioned and other observers, respecting the changes of the several constituents of the blood, or the causes of these changes. In fact, our whole knowledge of the chemical constitution of the blood in both health and disease is most unsatisfactory, and the statements of different writers vary so widely, that it is impossible to deduce any general laws from them. And I may add to this opinion of this able pathologist, that writers on the chemical constitution of the blood in disease have shown only how very little information they were able to give upon the subject; and that little evinces its insufficiency even for the purposes of either a theory or a hypothesis, and its almost total inapplicability to any practical purpose. It is, therefore, to the old fashion of observing the sensible changes and states of the blood, and of connecting these changes with the states of vital power and of vascular action upon which they manifestly depend, that we must recur with any hopes, in the present state of our knowledge, of practical advantage.

112. VII. The Pathological Anatomy of Pleurisy.—*A*. The earliest appearances of inflammation of the pleura are similar to those which I have described as being observed in inflammation of the Peritoneum (§ 81, *et seq.*), and consist of a congested state of the capillaries, which are congregated, here and there, beneath the still transparent membrane. The red colour produced by these vessels at certain points, deepens and becomes more diffused. These points are somewhat prominent, and, although scattered and distinct at first, they soon enlarge and coalesce. Patches and streaks are also observed, either darker than the rest, resembling small ecchymoses, or of a pale red hue, as if from imbibition. The pleura now becomes dull, and loses its polish and smoothness. The redness spreads and becomes more and more uniform. Soon afterward the rudiments of adventitious membrane may be perceived. The spots originally reddened by repletion of the capillaries present little, dull, whitish or yellowish points, which rise above the surface in the form of flat granules, and ultimately coalesce. The pleura, as Henle has shown, consists of several layers of superimposed cellular tissue, more and more closely attached to each other, the free surface being a thin layer of epithelium cells. Blood-vessels penetrate all these layers, excepting the exceedingly delicate epithelium membrane formed by these cells. The inflammation, therefore, is not seated, or does not commence, in the epithelium membrane, but in the subjacent cellular layers, this epithelium being thrown off at an early period of the disease. While these changes are proceeding in the pleura, the layers of cellular tissue connecting the pleura to the subjacent parts are more than usually vascular, and are more or less infiltrated with a yellowish, semi-gelatinous fluid; but this implication of the external cellular tissue is only occasional, or exists chiefly at the commencement, and is removed as effusion or other advanced changes take place. In rare instances only are alterations of the pleura and of the subjacent cellular structure observed to proceed, *pari passu*, with each other, more particularly as regards the costal pleura.

113. Consequent upon the changes now described, especially upon the grayish or yellowish points mentioned above, which are the initial and expanding rudiments of the consistent or membranous effusion, a slight, sometimes a much more abundant exudation of serum is also observed. When the progress of the inflammation is soon arrested these products are inconsiderable; but more frequently, and when the disease proceeds but little farther, the pleura is found as far as the inflammatory injection extends, to be lined by a very thin layer of plastic exudation, forming a delicate membrane, mostly opaque, which veils the inflammatory redness underneath it. The liquid effusion contained in the pleural cavity consists of a small quantity of a yellowish limpid fluid, or of a more abundant collection of a turbid, or of a reddish or mahogany-coloured serum, containing delicate flocculi. Hasse supposes that upon the condition of the thin adventitious membrane covering the pleura depends the length of time requisite for the absorption of the fluid; and that the more heterogeneous the quality of the former, the greater will be the impediment to the absorbents acting upon the latter. However, there are other circumstances besides the state of this membrane, which will either impede or accelerate absorption of the contained fluid, and it can hardly oppose any great obstacle, as it either enters into organic union with the serous tissue, or else it is gradually dissolved in the fluid.

114. When the inflammation either continues unabated, or steadily, and gradually, or more or less rapidly increases, the morbid products accumulate in proportion, exhibiting at the same time the most manifold differences. These differences depend more or less upon

iathesis or peculiarity of constitution and emperament, upon the grade of inflammation, upon its character and the degree of tone or of vital power attending it, and upon the state of the blood itself. The German and French pathologists, more especially Hasse and Andral, while they describe these differences with much precision, take insufficient note of the several pathogenic conditions upon which they certainly depend more or less; although it is very difficult to assign these differences or states of the inflammatory products in this disease to any one or more states of the system or of the circulating fluids, inasmuch as these products evidently undergo various changes after their accumulation and during their retention, and, moreover, the states of vital power, of inflammatory action, and of the blood attending their exudation and collection, soon change and become very different when they are retained for some time, these states being rather the consequences of the accumulation and retention of these products, and of the changes these products have undergone, than the causes of the differences or peculiarities they present when they become the objects of examination. To say, therefore, that variety of character in the products of inflammation of the pleura "is entirely founded on individuality," as some pathologists have contended, is to confess ignorance under the mask of a term. That the varieties observed are chiefly to be referred to the states just enumerated will be confirmed by more close and precise observation, although the difficulties of ascertaining the dependance of certain alterations upon determinate states of vital action, while the products of these states cannot be immediately examined, I am still disposed to believe. The exact appropriation of the several varieties of these products to the pathogenic states which produce them can hardly be expected, seeing that both the causes and the effects are the subjects of continual change; but an approach to it may be made sufficiently close for all practical and useful purposes.

115. *a*. The product of pleurisy, most simple, and most frequently observed, is a transparent yellowish jelly or lymph, and which is effused with great rapidity and in considerable quantity when the inflammation is intense. It is partly diffused in layers between the pulmonary and costal pleura, and partly subsides to the lowest part of the pleural sac in pellets or flakes surrounded by a small portion of fluid. This gelatinous exudation or lymph consists almost exclusively, and often in nearly equal proportion, of the fibrin and serum of the blood, the latter most frequently predominating, with a very little colouring matter, attracted here and there to the inflamed surface. It is *susceptible of organization throughout*, and blood-vessels form in it with surprising rapidity. Hasse met with a case in which plueritic pains occurred twenty hours before death, and found, at the corresponding part, this gelatinous lymph, in which delicate vessels were observed shooting from the borders. This product soon adheres to the surfaces of the pleura where they approach each other, and a very few days suffice to produce an extensive cohesion between the two. The rapid growth of vessels gradually confirms the union, and the aqueous portions of the effusion soon being absorbed, the formerly separate surfaces now adhere by means of a soft vascular and cellular layer or false membrane. The disease often terminates thus favourably, without the function of the affected part being materially or permanently disturbed. But the inflammation, having given rise to these changes, either partially or fully, and being nearly extinguished, may be rekindled, and the incipient adhesions may be stretched, or torn away, or even dissolved by the fluid poured out during the consecutive attack, and various other changes produced in the products previously formed, as well as other more novel deposites may take place.

116. *b*. The pleuritic exudation or lymph is not always of this organizable kind, or so german to the organism, owing to a depraved habit of body, to the state of vital power, and most probably, also, to the condition of the blood. Without, however, ascribing the difference to these states, Professor Hasse believes that ingredients very often enter into the composition of the pleuritic effusion which, either from too early consolidation, or, from some peculiarity of character, render it less susceptible of consolidation. These substances he considers as being far less easy of assimilation, and, acting as foreign bodies, serve to embarrass the surrounding parts. Adventitious membranes of this kind, and which are only *conditionally susceptible of organization*, appear not to form so rapidly as those just described. They generally consist of several either homogeneous, or else distinctly different layers, largely investing and firmly adhering to the pleura. Their consistence resembles that of a hard-boiled white of egg. They tear easily, and present, when torn, a fibrous-like texture. The colour of these plastic or albuminous masses is mostly of a yellowish or dull white; but they occasionally vary greatly, passing to a faint red, or into a violet or mahogany tint. The tinge is sometimes equable, but is also occasionally irregular, or patched, or streaked, or different in the layers or surfaces. These membranes are always opaque; their free surface is usually paler and softer than that adhering to the pleura, and is usually villous or reticulated. The cavity of the pleura contains, in addition to this false membrane, a considerable quantity of a slightly turbid or flocculent fluid, or a light-brown or reddish liquid, bearing some relation to the quantity and character of the false membrane. When there is a more complete development of blood-vessels in this membrane, there is also a smaller amount of fluid; and where, on the other hand, the organization of the membrane is imperfect or arrested, or when the consistent product is merely that of an unorganized coagulum, the fluid effusion is relatively more abundant, and, as Hasse supposes, with great probability, much less likely to be absorbed. It is not unlikely that exudations of the latter kind are liable to various changes during their retention, causing farther alterations in both the more consistent and more fluid parts, preventing or retarding the organization of the false membrane, and the absorption of the liquid. In these cases the disease is prolonged, and does not terminate favourably until the adventitious membrane has become organized and the fluid ab-

sorbed. But in those cases in which these results do not take place, the constitutional efforts caused by the morbid products, and the vital efforts made to resist the extension of the changes which these products occasion, produce a febrile or hectic state of the frame, which acts upon the local lesions, and these again react upon the constitutional disturbance until the vital functions are at last arrested. When the effused matters are much altered during retention, or assume a more morbid or irritating quality, even the partial absorption of them causes hectic of a more or less acute or rapid kind. Absorption of such matters is so constantly attended by hectic and emaciation, that Dr. Hodgkin, with much reason, regards the absence of these symptoms as evidence of its non-existence. It often does not proceed steadily, but remains stationary, until some intercurrent disease, in no way connected with the pleuritic malady, accelerates its progress.

117. *c.* When plastic matter or albuminous lymph is exuded in a very short period, by the intensity of the inflammation, *it does not enter into organic union* with this membrane, with which it is only loosely agglutinated, owing either to its rapid coagulation, or to the constitution of the exudation, or to the state of vascular action in the pleura. The coagulum then generally assumes the form of a honeycombed false membrane, or it presents imbricated layers; or it merely consists of irregular flocculent layers, whence scattered filaments run across the cavity of the pleura, while others shoot from the free surface, and give an irregular villous appearance to this surface. These plastic exudations are generally soft, opaque, and of a pale yellow hue. Along with the matter forming these depositions, a considerable quantity of liquid is also effused, which is sometimes tinged with the colouring matter of the blood, imparting in such cases its tinge to the whole morbid product. The more solid part of the exudation surrounds the more liquid portion, and forms an envelope for that portion; and being unorganized, and interposed between the fluid part and the pleura, prevents the absorption of that part. In these circumstances the disease becomes chronic, if death does not soon ensue, or assumes the form of *empyema*.

118. *d.* The *purulent* or *empyemic* form of effusion may be the result, as Hasse observes, either of a high degree of inflammation at the outset, or of the introduction of external air reacting on the inflamed serous surface and its product, during the progress of the disease. But may it not also arise from consecutive changes in the vascular action of the inflamed membrane, and in the effused fluid independently of the admission of the external air? I believe this to be the case in some instances. Suppuration of the pleura, however, is most marked where *pneumothorax*, with violent inflammation, follows the bursting of an abscess, or of a tubercular cavity into the pleural cavity. (*See art.* Pneumothorax.) In this case the pleura soon becomes dull and of a dingy gray, and secretes a thick tenacious, puriform fluid, covering the surface of the membrane, and collecting in the most depending portion of the cavity. In some instances a pure liquid pus is very abundantly formed, and is often mingled in various proportions with coagulable substances, especially with a very soft, thin, puriform, false membrane, which are either deposited upon or slightly adhere to the pleura, or which are mingled with the purulent fluid, in the form of pellets or flakes. Unless the pus find a ready outlet, or become sequestered within false membranes, this state of the disease soon terminates fatally.

119. *e.* Owing to the circumstance of the pleura being inflamed in different degrees, in different portions, or to the occurrence of a succession of attacks, or to the recrudescence of a subsiding inflammation, *several of the kinds of morbid product* above described are often met with in the same case. The most various combinations both of consistent exudation, organized, organizable, and unorganizable, and of liquid effusion, are thus sometimes seen in the same subject. Hasse justly remarks that pus, at whatever period it may be generated, stamps all other substances effused with its own impress. Plastic organizable exudations are thus liquefied and converted into pus; that which is coagulated turns yellow, becomes putrescent and flocculent, and, in like manner, resolves itself, partially at least, into pus. This statement, in fact, confirms the view which I have entertained above (§ 73) of the not infrequent conversion of other and more chronic states of pleurisy into that of a purulent or empyemic form, independently of the admission of the external air.

120. *f.* The *tubercular form* presented by the pleuritic products is one of the most important, and occurs chiefly in the scrofulous diathesis, and when tubercles at some one period of their development exist in other organs, especially in the lungs. As the tubercular constitution changes the plastic products of nutrition in particular structures, even in the circumstances of ordinary health, or causes the cytoblastemata of tubercle to be secreted conjointly with normal elements in these structures, so does it exert the same influence in the formative processes consequent upon inflammatory action. When pleurisy occurs in this constitution, and gives rise to the organizable or first form of product described (§ 115), there are seen, either simultaneously with the incipient formation of vessels, or earlier, dull points as large as pins' heads, scattered through the gelatinous effusion; and these points ere long change into granules. In the second form of false membrane (§ 116), tubercles likewise often appear in the shape of white, flat granules, distinct both in colour and consistency from the rest of the mass. These granules are inaccessible to the vascularity which soon pervades the organizable product. Professor Hasse remarks the existence of these granules, even the plastic substances deposited from purulent effusion, but he has never met with them in the adventitious deposites which are not susceptible of organization (§ 117). In pleurisy, as well as in other diseases, the characteristic influence of tubercles is exerted; for, by acting as substances alien to the organization, they keep up irritation, and the continued secretion of fluid and consistent matters; and they impede or frustrate the function of absorption. A portion, also, of these effects may be imputed to this particular diathesis, and to the circum-

stance of tubercles in various stages of growth being generally also present in other organs, more particularly in the lungs.

121. *g.* The *sanguineous state* of the products of pleurisy was particularly noticed by Laennec. The various grades of reddish colour imparted to pleuritic exudations by the colouring matter of the blood have already been slightly mentioned. Sanguineous coloration of the fluid effused is most frequent in the tubercular states of pleurisy. It is only in rare instances that the blood itself exudes into the pleural cavity in this disease; and when this occurrence takes place, little clots are found at the bottom of the collected serum, or deposited between false membranes. Instances of the entire effusion, consisting of pure blood, are mentioned by Andral and Hasse; but these should be referred rather to hemorrhage into the pleural cavity than to inflammation of the pleura. Even when blood is effused into this cavity it will necessarily produce inflammation; and hence, in cases where pure blood, or clots of blood, are found in this cavity in connexion with inflammatory products, it may be difficult to determine that these are not the products of an inflammation excited by a primary hemorrhage into the pleural sac, effused blood generally causing inflammatory action in the tissues surrounding it.

122. *h.* The spontaneous evolution of a *gaseous fluid* from the products of pleurisy has been believed in by some pathologists, and denied by others. The question at issue is, whether or not these products may become so decomposed during the life of the patient as to form a gaseous fluid. We know that this effect is not unfrequently observed after death. Dr. Hodgkin doubts the possibility of it during life, and Andral and Hasse appear very nearly to agree with him; for, in instances which occurred to them, in which gas seemed to have been spontaneously evolved from these products, they admit the possibility of some perforation of the pleura to have existed, although they failed to detect it. Although the exuded matters, fluid as well as more consistent, may long remain either unchanged, or but slightly changed, as long as the vital energies are not very much impaired, yet when these energies are very far reduced, the products of inflammatory action are either insufficiently, or no longer controlled by them, and various changes must ensue. Some of those changes may be ascribed to endosmosis and exosmosis; others to the states of vascular action and of absorption; and a portion even to incipient putrefaction; but death usually occurs before this last proceeds far. The ulterior changes of the more fluid matters effused in pleurisy are as yet not fully ascertained, especially with reference to the different grades of vital power; and the question as to the spontaneous evolution of gas from these matters, in the most unfavourable circumstances of the disease, and when vital power is remarkably reduced, still remains undecided.

123. *i.* The most important change that takes place in the gelatinous and more consistent products of pleurisy is their *vascular organization.* This process has been explained in two ways. Döllinger and others have supposed that the exudation, possessing a derived grade of vitality from the surface producing it, has hence the power of producing a movement of its molecules, of transforming these into blood-globules, and of developing canals for their circulation independently of any connexion with the blood-vessels of the surrounding tissues, the circulation in the false membrane becoming connected with and subject to that in these tissues only subsequently, and by slow degrees. This theory has not been supported by accurate and direct observation, and it has only the remote and loose analogy of the incubation of the egg to support it: a process which possesses elements entirely wanting in the organization under consideration. The other explanation is more obvious, and admits of visual demonstration. It has been observed by Hasse, Kiernan, Hodgkin, myself, and others, in various stages of its progress; and it may be briefly stated, that, wherever vessels had formed in adventitious membrane, they proved to be continuations of the branches ramifying in the serous coat, having penetrated the false membrane at numerous points, and then branched out in a stellate manner, or having formed into partly divergent, partly parallel, fascicular groups. In those false membranes which are less organizable, or only conditionally so (§ 116), the descriptions of Laennec, Forbes, and Gendrin show that a multitude of little red elevations appear on the serous membrane, like clusters of protruding vessels. These elevations impress corresponding pits in the adhering surface of the false membrane, and upon the surfaces of these pits appear little arborescent or stellate extravasations of blood. By degrees these arborescent extravasations become more strongly marked, and assume the appearance of vascular ramifications. Laennec states that these ramifications present an outer and softer layer, formed by desiccated blood; and that this layer encloses a small whitish chord of coagulated fibrin, apparently hollow in the centre, and pervious to the blood stream. These thick-walled canals gradually change into the natural coats of the vessels, which, pursuing their course, thus seek to traverse all the organizable portions of the false membrane. Professor Hasse remarks, that some plastic substances are possessed of so little power of attraction over the capillary vessels of the inflamed pleura as neither to form these little vascular prominences, nor to occasion the little stellated extravasations on the new membrane. These heterogeneous formations go on irritating the pleura until another false membrane is thrown out, which, acting as an intermediate vascular link, establishes something approaching to vegetative reciprocity between the two; and, being itself devoid of nerves, obviates morbid irritation.

124. *k.* Whatever does not sooner or later become assimilated or organized; whatever is not converted into vascular cellular tissue, or is not removed by absorption, remains perfectly isolated and encysted, and may, in some instances, be retained for years without occasioning any serious symptoms. When the more fluid parts have been absorbed, the more solid constituents remain, forming a pap-like mass of the consistence and aspect of moist cheese, or of imperfectly-coagulated white of egg. "Previously to this, the effused product usually sinks

to the most dependent part of the cavity of the pleura, so that the above mass accumulates into a layer more or less thick, between the two firmly-adhering and thickened pleuræ, posterior to the inferior lobe of the lung." When tubercle enters into the combination, and the case does not prove rapidly fatal, it is occasionally met with as a residue of the aggregate morbid product in small scattered portions included between the pleuritic adhesions. In such cases, various consecutive changes sometimes take place, which will be noticed hereafter.

125. *l.* When the fluid, instead of being removed by absorption, makes its way out of the pleural cavity, the lung is the part most frequently perforated; and it is the superior anterior portion of the organ which is most commonly the seat of perforation. Hasse states that this does not take place where the lung has suffered compression, but where it has continued to expand—in the majority of cases, at the inferior surface of the upper and middle lobes. Such portions are commonly attached by old adhesions to the costal pleura, and form an arch over the effusion. The effusion presses against this arch, until some point of the substance of the lungs and of the pleura softens, gives way, and allows the fluid to escape through the bronchi. The perforation may, however, take place at the inferior lobe, or at the base of the lung, especially when protected from compression by old adhesions, and remaining partially pervious to air. These perforations are rounded or oval, are smooth at their edges, and seldom exceed two or three lines in diameter. They are generally single. The parenchyma in the vicinity of the perforation or fistula is generally in a state of gray hepatization, or of complete purulent softening. This change is usually fatal; but Andral and Heyfelder have met with instances of recovery.

126. The passage of empyema through the diaphragm is very rare. Andral and Mohr have adduced instances of this occurrence. In these the fluid, after perforating the diaphragm, pushed down the peritoneum before it, thereby preventing effusion into the peritoneal sac. In one of Mohr's cases the diaphragm was perforated near to the spine, and the pus descended behind the peritoneum, along the psoas muscle, causing abscesses and fistulous openings in the thigh, extending as low as the knee. Gendrin mentions a case in which the fluid made its way into the anterior of the mediastinum. Escape of the effusion through the thoracic parietes presents a better chance of escape for the patient than the foregoing. The chief cause of the spontaneous evacuation of the fluid of empyema through the bronchi and thoracic parietes being so often fatal, is the influence of the external air upon the diseased pleura and upon the walls of the fistula, especially upon the substance of the lungs. The purulent secretion soon becomes remarkably fetid, and the air which passes into the cavity is soon deprived of its oxygen. Davy found the air in pneumothorax to consist of 0·92 of nitrogen, and 0·08 of carbonic acid. The fluid of empyema generally evolves the odour of phosphureted and sulphureted hydrogen.

127. *m.* The *state of the lungs*, in cases where the pleural cavity is surcharged with effusion, has been described by several modern writers. The lung of the affected side suffers the most, as may be expected, its compression being commensurate with the increase and ascent of the fluid, until it can no longer expand, and the air can scarcely enter the partially compressed bronchial tubes. When the lung is free from adhesions, it is pressed upward and forward, and finally on all sides towards its roots, when the bronchi and blood-vessels penetrate. It then occupies the least possible space in front of the vertebral column; is flattened and shrivelled; its different lobes are mostly adherent; the parenchyma is inelastic, devoid of crepitation, and almost bloodless; and generally without tubercles. When, however, tubercles are developed in the course of chronic pleurisy, or are advanced, having previously existed—a thing by no means rare—they are not found in the most compressed portions of lung. The bronchial tubes are usually found loaded with a whitish, tough mucus. Where adhesions exist, these generally preserve a portion of lung more or less expanded, the bronchi then remaining partially pervious to the air, and tubercles are not unfrequently seen in the partially-expanded portions of lung.

128. The mode in which compression of the lung presents itself in those cases in which adhesion between the opposite surfaces of the pleura exist has been described by Mohr (*op. cit.*, p. 127). Out of forty-three cases, six of which were double, the compression and displacement of the lung were once in the direction from above, downward; four times from behind, forward; four times from before, backward; four times from within, outward; thirteen times from below, upward; and twenty-three times from without, inward.

129. *n.* The *appearance* and *structure* of the adhesions formed between the lung and costal pleura, and between the lobes, differ; but they may be referred to two kinds: *First*, the cellular, in which the opposite surfaces are equally united by means of a dense cellular tissue; and, *secondly*, the filamentous or band-like, separate bridles or bands, having a smooth, serous surface passing between the two pleural surfaces. These bands appear identical with the serous membrane, whose product they are, and into which they directly pass. They are often supplied with blood-vessels of considerable size; and they consist of densely stratified cellular tissue, with an investment of epithelium cells; and they sometimes contain, as remarked by Laennec, Hasse, and myself, a considerable portion of fat within this texture, more especially in their centres (see above, § 100.) As shown by Beclard, Dupuytren, Villermé, and others, these adhesions may remain during life without occasioning any sign of disease; but I have met with cases in which their existence and situation have been inferred, and the inference has proved correct, as shown by dissection, years afterward. They may even disappear in the course of time. In the latter case the chords lengthen, become thinner in the middle, and ultimately rupture, nothing excepting a whitish, rugose thickening of the pleura remaining.

130. The adhesions following and complicating tubercular disease of the lungs are different from those observed in primary pleurisy. They commence at the apex and gradually de-

scend, closely following the course and extension of the tubercular disease. Professor Hasse considers these adhesions as being less the result of decided inflammation than of a chronic irritation, limited in degree, and kept up hy the proximity of the heterologous product. The result is complete hlending of the pulmonary with the costal pleura, with lardaceous thickening, and degeneration of the serous structure. Owing to this intimate fusion, the intercostal vessels push branches into the diseased substance of the lung. In favorable circumstances to the development of inflammation, the slight irritation, causing the insensible, or nearly insensible, adhesion of opposite portions of the pleura, may amount to actual inflammation, rapidly spreading over the pleura, and throwing out diverse products, generally with tubercular matter, and passing into chronic pleurisy. Mohr calculates the complication of pleurisy with tubercular diseases of the lungs to be fifteen cases out of twenty; and this appears to be near the truth.

131. *o.* It is comparatively rare to find pleuritic lesions simultaneously in both cavities. Hasse states, that of thirty-five fatal cases he found nine double cases; and in five of the nine one sac was implicated in a minor degree. He considers both sides of the chest to be almost equally prone to the disease, with this difference, that pleurisy of the left side is both more likely to prove fatal in the acute stage, and more apt to pass into a chronic state; but he adds, of the thirty-five cases just mentioned, sixteen were of the left side, and ten of the right, the other cases being double. Of fifty-six cases observed by Mohr, the left side was the seat thirty-seven times, and the right nineteen times. The experience of Dr. H. Roe and Dr. Hughes, also, shows a much greater frequency of the disease of the left than of the right side; and the cases which I have seen, since my attention has been directed to the matter, also evince a much greater frequency of pleurisy of the left side. In 1846 I met with four cases of the disease in this side in succession.

132. MM. Rilliet and Barthez state, that simple pleurisy is more frequently met with in the right than in the left side in *children;* but that pleurisy complicated with pneumonia occurs oftener in the left; while the simple and complicated cases united are more frequently seen in the left than in the right. Of all the products of inflammation in this class of subjects, these physicians found that false membranes were the most frequent, and these were sometimes the only lesion; next to these was a turbid serum, a purulent fluid being the most rare.

In 85 cases, false membranes were present in 79.
- In the right pleura only, 27.
- In the left only, 38.
- In the two cavities, 14.

In the 79 cases in which there were false membranes, they existed alone or with redness only, 28 times.
- In the right pleura only, 14.
- In the left alone, 13.
- In both, 1.

133 VIII. The Diagnosis of Pleurisy requires only a very brief notice, after the full descriptions which have been given above of the symptoms, signs, and consequences of the disease.—*a.* The greatest difficulties as to diagnosis present themselves in cases occurring in *children*, and in *adults* when the physician has not observed the earlier stages, or when the pleurisy is latent, and the quantity of fluid effused is not great. In infants and children under four or five years pleurisy is most frequently associated with pneumonia; but after that age it is often primary and uncomplicated. During *infancy*, pleurisy is detected with great difficulty; but it should be dreaded when the patient is seized with violent and constant crying or screaming, restlessness, hot and dry skin, dry, short cough, and the appearance of increased suffering upon being raised to the erect posture. Upon inspection of the chest, the side affected does not move so freely as the other during respiration, and auscultation detects a rubbing or creaking sound, which usually continues longer than in adults. In very young children there are generally also signs of pneumonia, especially crepitation, associated with these, and occasionally there is evidence, moreover, of bronchitis. In older children pleurisy is also often complicated with pneumonia, and, in rarer instances, with pericarditis; but in these latter, acute rheumatism is generally also present, or it has immediately preceded the thoracic complication. The chief difficulty, however, is in distinguishing pleurisy from pneumonia, and in ascertaining during life the existence of the association of the two diseases. The former usually commences in children with dry cough and acute pain, soon followed by a bronchial respiration, inspiration being attended by a metallic sound, while the respiratory sound is rarely much impaired, unless the disease is advanced. Change of position aggravates the symptoms. The febrile symptoms generally abate from the fourth to the seventh day; and previously the rubbing or creaking sound is often heard, especially before effusion has taken place; but this sound may also be present when the lung is implicated. In this latter case, there are generally also crepitation or sub-crepitation, accompanying bronchial respiration and mucous expectoration, which in older children is often copious and even tinged with blood. When the lungs are thus also affected, the febrile symptoms are usually more severe, and continue until the 7th, 8th, or 9th day, before they abate.

134. *b.* In the earliest stage, the pain of pleurisy may be mistaken for *pleurodynia*, or nervous pain in the side; for the absence of any distinctive physical sign at this period, unless in such cases as may furnish a rubbing or cracking sound, leaves us without proof of the existence of the disease, excepting that which may be inferred from short, dry cough, heat of skin, hardness or sharpness of the pulse, and other febrile symptoms, and these may be very slight, or insufficient to indicate the nature of the malady. But not only may these be so slight as to be almost wanting, unless occasionally towards evening, but pain itself may be wanting, or be so situated, and so slight, unless in motion or on exertion, as to render the disease entirely latent, as stated above (§ 49), until the effusion is so considerable, as it usually is in a short time, in these cases, as to develop the physical signs (§ 24).

135. *c.* Pleurisy may also be mistaken for *consolidation of the lung*, and this latter for it. This mistake is most likely to be made when the pleurisy is attended by a moderate amount of effusion, the walls and contents of the chest not being displaced. This lesion of the lung generally increases the vocal resonance of the affected side, whether heard or felt by the hand, and allows some sound of respiration, which is generally of a bronchial character, to be heard; and it thus may be distinguished from this state of pleurisy. "Partial pleurisies confined by adhesions," as Dr. Williams justly observes, "are less easily distinguished, because, where the lung is adherent, there may be as much bronchophony and respiration as in cases of consolidation; but, on examination, these will be found to be more circumscribed than in the latter case, all sound being absent in other parts, which farther present the signs of enlargement or displacement of the heart, liver, or mediastinum, with fulness of the intercostal spaces, generally more remarkably than usual. A similar irregularity in the shape of the chest will serve to distinguish pleurisy in the progress of cure by contraction of the chest, from the case of a consolidated lung." (*Op. Cit.*, p. 122.) Although I admit the truthfulness of these remarks, as respects many cases, yet others will occur to which they do not apply, and in which they cannot assist the diagnosis. They apply chiefly to the more developed and well-defined cases; but to others not so characterized, and to those which are more complicated, they will furnish but slight aids. Indeed, no precise statements can be offered as to the diagnosis of several states of pleurisy attended by adhesions, partial effusions, and alterations of the substance of the lungs, as none apply sufficiently to these ever-varying states to mark them with precision. The physician's accuracy of diagnosis, as regards them, will depend much upon the attention with which he has watched the course of the disease, and upon his acumen in detecting, and his sagacity in comparing and estimating signs, symptoms, and almost imperceptible and evanescent phenomena.

136. *d.* Chronic pleurisy is liable to be confounded with *tuberculous disease of the lung*, for some of the signs of both maladies are somewhat similar, and the constitutional symptoms and affection are often alike. Indeed, the one may pass into the other, or both may be present. There never is, however, the same amount of dulness on percussion and absence of respiration in the latter malady as in chronic pleurisy; while the enlargement of the side and displacement of the viscera, attending pleurisy with very copious effusion and empyema, never exist in phthisis. The puriform state of the expectoration, often observed at an advanced stage of chronic pleurisy, should not mislead the physician, for this appearance of the sputum occurs in the last stages of most diseases of the chest, and is an attendant upon a sympathetic chronic bronchitis, which gradually supervenes in their advanced progress, and is independent of any actual disease of the substance of the lung.

137. *e.* Protrusion of the intercostals may be looked upon as the surest sign of *empyema*; for it rarely accompanies a very copious and non-purulent effusion in the acute stage, while it is generally present when the fluid is purulent, although actually smaller in quantity than before it assumed this character; this sign indicating rather the kind of fluid than the quantity, as justly insisted upon by Dr. Stokes and Dr. H. Roe. It should also be recollected that a small effusion into the right cavity may, when the patient is examined in the sitting or standing position, be mistaken for an enlarged liver, or the rising of this organ high in the thorax, or this latter may be mistaken for the former; while the presence of a considerable quantity of fluid in the left side may not be detected, owing to an inflated stomach having pushed the diaphragm before or behind it, or to the small quantity of fluid interposed between the parietes and the inflated organ, admitting of a clear sound upon a strong percussion, although a dull sound may be given out by a very gentle percussion. The absence of the vibratory thrill produced by the voice, and the decubitus, generally on the affected side (§ 30, *et seq.*), will farther determine the seat of effusion.

138. At an advanced period of empyema a copious expectoration of purulent matter may occur, and may lead to the inference of the existence of a pneumonic abscess, or of a tubercular cavity, or, at least, of chronic bronchitis, of the uncompressed lung. Instances of this kind have been noticed by Andral, Stokes, and Mac Donnell, and upon dissection no such complication could be detected. But true pulmonic abscesses are comparatively rare, and are not accompanied with copious expectoration. The last writer just named very justly infers that purulent expectoration in empyema, although attended by quick pulse, sweating, emaciation, and other hectic symptoms, is indicative of tubercular or pneumonic abscess, unless attended by unequivocal physical signs of these lesions; but, on the contrary, it is to be regarded as the consequence of an effort of the constitution to get rid of a large collection of purulent matter by one of the ordinary emunctories.

139. It should, however, be kept in recollection that the lung of the sound side often experiences, in the course of empyema, congestion of the mucous membrane of its bronchi, or fully-developed bronchitis, often passing into chronic bronchitis. In such cases the accession of chills, rigours, fever, increased difficulty of breathing, with the physical signs of bronchitis, generally indicate the complication, which in various degrees is a frequent consequence of the increased determination of blood that takes place to the sound lung, owing chiefly to the compressed and impermeable state of the lung of the affected side.

140. When a circumscribed purulent collection forms on the left side and advances externally ("the *empyema of necessity*" of French pathologists (§ 52, 56)), it may, owing to the pulsations of the heart communicated to it, be mistaken for a thoracic aneurism, or even for a malignant tumour in that situation. Mr. Mac Donnell has pointed out this circumstance, and has published some interesting cases illustrative of this form of empyema, which he denominates "*pulsating empyema of necessity.*" It may be distinguished from *thoracic aneurism*, (*a*) by the history of the case; (*b*) by the dulness extending over the whole side, the pulsation being felt only in the external tumour; (*c*)

by the absence of thrill, and of bellows sound; and (*d*) by the extent and nature of the fluctuation. It cannot be mistaken for *encephaloid*, or other malignant disease, if the progress of the disease, and the existing phenomena, have received even tolerable attention. The absence of a persistent bronchitis, of a dark expectoration resembling black-current jelly, and the absence, also, of a varicose or enlarged state of the veins of the surface, and of œdema of the side affected, will assist the diagnosis.

141. It was shown by me in 1815, and on subsequent occasions in 1820, 1824 (see *Med. and Phys. Journ.*, vol. xliv., p. 530, and Notes to Richerand's Physiology, p. 626), long before the subject was noticed by Tiedemann, Gmelin, Liebig, and others, that, when the functions of the lungs are in any way impeded, the liver often performs a vicariously increased function, thereby preserving the blood from the impure or morbid state into which it would otherwise pass. This increased function of the liver is very generally remarked in the course of empyema. But, in addition to increased function, there also not unfrequently supervene congestion, and more or less enlargement of the liver, owing to the difficult or impeded circulation of blood through the lungs, and the equally impeded return of it from the hepatic vein. This enlarged, or at least congested, state of the liver, in most cases of empyema of any considerable duration, should not be overlooked, or mistaken for a partial empyema of the right side, which, however, it may accompany as well as empyema of the left side. The enlargement of the liver from congestion, or from impeded and impaired function of the lungs, generally supervenes to the vicariously increased action of the organ, and is observed chiefly in the more chronic cases of empyema.

142. *f.* The diagnosis between pleurisy with effusion and *hydrothorax*, and between empyema and this latter, is by no means easy, unless the history of the case be well known. The circumstance of hydrothorax being generally consequent upon disease of the heart, upon a far advanced stage of disease of the lungs, especially congestive pneumonia, œdema of the lungs, &c., or upon the last stage of other forms of dropsy, as ascites, anasarca, &c., is sufficient to prevent any difficulty in the great majority of cases to which the term hydrothorax is strictly applicable. Yet passive effusion may occur, although in comparatively rare instances, either in one or in both lungs, and be distinguished with difficulty from the asthenic and latent forms of pleurisy, more especially when the passive effusion is confined to one side of the chest, which is seldom the case when altogether independent of inflammation of the pleura. When dropsy of the pleura, however, is caused by disease of the lungs, it is then generally confined to the same side as the affected lung, or is greatest on that side.

143. In most cases, the chief differences that can be observed between chronic pleurisy or empyema and hydrothorax are, that the dilatation of the intercostal spaces is comparatively slight in hydrothorax, while protrusion of them or of the diaphragm is not observed in this latter. Dr. Stokes imputes this circumstance chiefly to the pathological state of the pleura and the adjoining muscles, and to the puriform character of the effused fluid; but something may also be imputed to the amount of effusion, which is rarely so great in either pleura in pure hydrothorax as in pleurisy, and hence a change of sound, varying with the position of the patient, may generally be recognised in hydrothorax, unless the passive effusion is consequent upon the existence of several old pleuritic adhesions. Dr. Stokes adverts to the following diagnosis between empyema and hydrothorax, as given by Hippocrates and noticed by Laennec: "You shall know by this that the chest contains water, and not pus, if, on applying the ear during a certain time on the side, you perceive a noise like that of boiling vinegar;" and remarks that, when we consider the conditions of the lung in empyema and hydrothorax, the diagnosis of Hippocrates seems much more accurate than Laennec has admitted. In empyema the lung is but rarely affected, and no râle is heard, "no sound of boiling vinegar;" while hydrothorax rarely occurs without more or less œdema or congestion of the lung; so that, the presence of liquid in the chest being admitted, the occurrence of râle would indicate hydrothorax rather than empyema.

144. IX. Prognosis.—The prognosis of pleurisy depends upon the form, state, and progress of the disease; upon the previous health and age of the patient; upon the rapidity and amount of the effusion; and upon the duration of the malady, in connexion with the treatment which has been employed. The sthenic forms of the disease occurring in previously healthy persons, and brought early under treatment, although serious in their consequences, and therefore requiring a most watchful attention, generally yield to judicious treatment, especially when employed promptly, or before effusion into the pleural cavity has become abundant. If, however, pleurisy have been neglected, or improperly treated; if it have attacked a cachectic or broken-down constitution, or assumed an asthenic form; if it have been latent, and hence existed for some time before it was recognised; if it have supervened upon disease of the lungs, heart, liver, or peritoneum — more especially upon tuberculous deposits in the lungs, it is a most dangerous, and in the latter circumstances more especially, even fatal malady.

145. When the disease attacks a person who has been exposed to depressing agents; to cold, humidity, insufficient nourishment, and anxiety of mind; when the effusion increases rapidly, notwithstanding the employment of judicious means of cure; when it appears in the scrofulous diathesis, or affects the pleura of both sides, or is attended by purulent expectoration, emaciation, or night sweats, or when the constitutional symptoms assume the hectic character; when debility increases, and the urine becomes scanty, or œdema of the extremities supervenes; and especially when these very unfavourable symptoms advance or continue for some time, the danger should be considered as very great, more particularly in the latter circumstances now enumerated. The prognosis in the complicated, the chronic, and the empyemic states of the malady is always very unfavourable, but more especially when occurring in the debilitated, the cachectic, and intemperate; the amount of danger being generally extreme when the disease has for some time re-

sisted the usual remedies, or when the constitutional powers give way.

146. In those cases of empyema in which the matter finds its way through the lungs or external parietes of the chest, although the danger is great, still recovery may take place if the vital influence be not much impaired, if hectic symptoms be not developed, and if extensive disorganization be not present. The strength, constitution, and age of the patient, in connexion with the other circumstances of the case, should guide opinion as to the result. In the great majority of instances, however, the spontaneous evacuation of the fluid affords only temporary relief, the subsequent discharge and the hectic fever ultimately sinking the patient. The prolonged retention of the matter, and the consecutive changes in the lungs and parts adjoining the fluid collection, before a spontaneous discharge can be effected, generally sink the constitutional powers, and prevent a restoration of the lesions which have taken place, which are, however, usually too extensive to admit of restoration under any circumstances. Those cases in which the discharge is procured by operation admit of a much more favourable prognosis, especially when the operation has not been too long delayed, or until the alterations of the lungs and adjoining organs and parts are not rendered too great to admit even of a partial removal; but in these cases the result much depends upon the peculiarities of the case, and the circumstances under which the operation is performed.

147. Acute pleurisy seldom proves fatal merely from the amount of the effusion, until it is passing, or has passed, into the chronic state; and even then, so rapid a termination is met with chiefly in the cachectic, and in cases of double pleurisy, or when previous disease exists in the lungs or some other viscus. The rapid accumulation of the fluid, however, is a very unfavourable occurrence in any circumstances of the case, as it indicates great defect of constitutional power, and an inability to effect its removal. An opinion of the result cannot be formed correctly in any case of the disease, until the more acute symptoms have subsided, or until the effects of the means usually employed for this purpose become apparent; and then the issue depends much upon the age and constitution of the patient. When the sounds of percussion and respiration return, however gradually, and the other symptoms and signs disappear, a doubt need not be entertained of a favourable result, especially if the lungs furnish no indication of disease.

148. X. Pleura-pneumonia—*Pleuro-pneumonia—Pleuro-pneumonitis—Peripneumonia—Peripneumony*, &c.—or the association of inflammation of the pleura with that of the substance of the lung, is so frequent, that these distinct diseases have been very often treated of as one, and with the belief that the one does not occur without the other. This, however, has been shown not to be the case, although they are frequently conjoined, as I have shown above, and when treating of inflammation of the lungs (*see art.* Lungs, § 73, *et seq.*). The intimate connexion subsisting between inflammations of the pleura and of the pulmonary parenchyma, and the frequent complication of these diseases, lead me further to remark, that *pleura-pneumonia* presents itself in practice in *three states*, which present certain differences in their progress, according as either tissue is prominently affected: 1st. *Pneumonia* associated with slight pleurisy; 2d. *Pleurisy* complicated with slight pneumonia; and, 3d. *Pleura-pneumonia* properly so called, in which the two affections seem nearly equal in degree.

149. i. *Pneumonia associated with slight Pleurisy.*—In those cases in which inflammation of the lung reaches to the pleura, in any point, lymph is thrown out upon the free surface of that portion of pleura; but in persons of a previously healthy constitution, the lymph effused is usually in small quantity, forming a false membrane, which extends no farther than the portion of pleura covering the inflamed or hepatized portion of lung immediately underneath. If the disease be of the sthenic character, or if it be unconnected with cachexia, constitutional vice, or a contaminated state of the circulating fluids, the inflammation, thus extending to a portion only of the pulmonary pleura, does not spread over the surface of this membrane, although the lymph thrown out will frequently excite a corresponding irritation or inflammation of the portion of the costal pleura with which it comes in contact, and thereby give rise to adhesions between the opposite surfaces. If the pneumonia and consequent hepatization occupy a portion only of the lung, the effusion on the serous surface is only slight, consisting of a sero-albuminous, or sero-puriform exudation. But if nearly the whole lung be affected, then there is often little or no effusion, a very thin or imperfect false membrane only being seen on its serous surface, which is thicker along the edges and in the interlobular fissures, and in some other points when the inflammation had first reached this surface. This is a very common form of *dry pleurisy*, complicated with pneumonia; and in this complication the pleurisy is merely contingent upon the pneumonia, and scarcely at all modifies the severity or progress of the primary disease. M. Laennec remarks, that it would be very difficult to distinguish this particular complication from a pleurisy with copious effusion, if the patient had not been seen before this period; the absence of the thoracic resonance is here as complete as if the whole surface of the lung were covered by a pleuritic effusion, while the stitch in the side commonly attending the extension of the inflammation to the pleura would farther induce the belief that the disease was simple pleurisy. When, however, the lung is completely hepatized, without any attending effusion into the pleural cavity, there is always a strongly marked bronchophonism in different points, and particularly toward the summit and root of the lung: a sign which never exists in the same degree, or over the same extent, in pleurisy or pleuro-pneumonia. If the patient have been seen from the origin of the disease, the diagnosis is much more easy. If the disease be pneumonia, crepitation will have been heard previously to the complete cessation of the respiratory murmur; and the gradual diminution of the resonance on percussion, and the supervention of a friction or rubbing sound, as described when treating of the *dry form* of pleurisy (§ 42, *et seq.*), will leave no doubt of the nature of the affection. In pleurisy the loss of resonance is very rapid, and exists, if the lungs have been previously

healthy and without adhesions, over the whole of the affected side. Œgophonism, moreover, is always perceptible, at least for one or two days.

150. ii. *Pleurisy complicated with slight Pneumonia.*—If the pleuritic attack be severe, and the effusion so rapid and abundant as suddenly to compress the lung, it is not uncommon for inflammation of some points of the pulmonary substance to occur, particularly in the lower lobe. These points sometimes remain distinct and of small extent, constituting one of the varieties of *lobular pneumonia*. The pulmonary inflammation is here much modified by the pleuritic effusion, as I have shown in the article Lungs (§ 73), and it rarely extends much farther than a few lobules, and still more rarely advances to suppuration. This complication can only take place early in the attack, and before the effusion and consequent compression of the lung have become very considerable; as a lung greatly compressed is hardly susceptible of inflammation, the *symptoms* and *signs* of this complication are described in the article now referred to (§ 75).

151. iii. *Pleuro-pneumonia, properly so called.*—The association of an inflammation of the whole or part of the pleura, with considerable effusion, and of a severe pneumonia, is not so frequently met with as either of the two complications just mentioned. M. Laennec remarks, that pleurisy conjoined with pneumonia does not increase the danger of the latter; on the contrary, it lessens the danger, as above stated, by compressing the lung. On the other hand, the pneumonia at first augments the danger of the pleurisy, which is rarely fatal in the acute stage; but it favours a more rapid absorption of the effusion, by preventing this from becoming as copious as in simple pleurisy, the inflammation rendering the lung less compressible. Hence pleuro-pneumonia, *cæteris paribus*, may be regarded as less dangerous than either simple pleurisy or simple pneumonia.

152. Pleuro-pneumonia is recognised by the union of the signs of pleurisy and of pneumonia; and some of these signs are even more permanent in this complication than in either of the simple affections; for they mutually impede and retard each other's progress when these inflammations are conjoined. The crepitation on the one hand, and the œgophony on the other, are thus often heard up to the period of convalescence. In cases of this kind, œgophony is seldom simple; it is perceptible only at the root of the lung, around the lower angle of the scapula; and, from the vicinity of the large bronchial trunks, and the density of the pulmonary substance, it is usually combined with marked bronchophony. This conjunction of these two signs Laennec has likened to the squeaking of Punchinello.

153. XI. Treatment.—i. History of the Treatment of Pleurisy.—(*a*) Among the several means advised by the older writers for the cure of pleurisy, *blood-letting* was considered of the first importance; but there are various circumstances which have been noticed in connexion with it by these writers that deserve a brief notice. Hippocrates advised bleeding "ad deliquium animi." Aretæus insisted upon the necessity of early and repeated venesection, but cautioned against carrying it so far as to produce syncope. He distinctly stated the nature and seat of the disease, and remarked that it was neither sporadic nor epidemic. Aëtius was the first to point out some of the conditions which indicate the impropriety of having recourse to blood-letting, and imputed these conditions to indigestion and crudities of the stomach. Cælius Aurelianus and other Methodists advised blood-letting, but condemned the practice of carrying it to the length of causing syncope. Alexander Trallianus seems to have been the first to advise local depletion for this disease, according to the manner of cupping then in use. Avicenna, and other Arabian physicians, generally had recourse to venesection and cupping, and the rest of the antiphlogistic plan.

154. The question as to the greater efficacy of bleeding from the same side as that affected in pleurisy, or from the opposite side, was agitated at a very early period. The Greek and Latin authorities were divided in opinion as to this question. Hippocrates, Galen, and Celsus advised bleeding from the arm of the affected side; while Aretæus, Aëtius, and Cælius Aurelianus directed it from the opposite side. The discussion was carried down by the Arabians, who, however, generally bled from the arm of the unaffected side; and by the writers of the fifteenth, sixteenth, and seventeenth centuries, some of whom, as Amatus Lusitanus, Vesalius, Trincavelli, Ruland, Saillans, Wipacher, Rodriguez, Bertin, and others, discussed the subject as one of the utmost importance.

155. Other circumstances, of greater moment than this, were at last noticed in connexion with bleeding for pleurisy, by Sydenham, Callisen, Baglivi, and others, who insisted upon the injurious tendency of bleeding in cachectic and asthenic states of the disease, or when the blood did not present a buffed or cupped appearance. Mursinna, Stoll, and many recent writers have likewise cautioned against bleeding in these cases, as well as in those which present a putrid character, or a bilious in connexion with an asthenic diathesis; and have likewise warned the inexperienced against repeating venesection, or carrying it too far merely because the blood was buffed: a caution of no small importance.

156. There can be no doubt of pleurisy being much more prevalent at some seasons or in certain years than at others, and thus assuming, according to the circumstances of season or locality, more or less of an *endemic*, or an *epidemic* form; and there is no less doubt of the character of the disease varying remarkably at different periods and in distinct localities; it being, in one or the other, of a much more phlogistic and acute form than in the rest, or assuming even an asthenic or latent character. And hence, indeed, may arise the fact that blood-letting and other parts of the antiphlogistic treatment have been advised with very different degrees of boldness by different writers. We find that, since the days of Galen, prejudices existed in Rome against large bleedings in this and other acute diseases; and these were very probably well founded, in respect of that and all other large cities in ancient times, as they are as regards this city and other large towns at the present day. The opinions of medical writers are

too generally based upon the narrow or peculiar circumstances of their own practice, either previously to or at the time of their writing; and all have neither the inclination nor the time to acknowledge the change of opinions which farther experience and more diversified opportunities have occasioned. We find that Dover, Cleghorn, Huxham, and many others advised very large, prompt, and repeated venesection; and that Riverius, Le Mercier, Stoll, and Sims recommended that it should be performed in both arms at the same time. A more enlightened experience, and more diversified opportunities of observation, have now demonstrated that this practice may have been appropriate in many of the circumstances in which these writers had recourse to it; but that there are other circumstances, in respect not only of the individual, but also of the season, locality, and epidemic constitution, which render it altogether unsuitable and injurious; while there are certain conditions of the disease which I have endeavoured to point out, that require very different or even opposite measures. In the more doubtful circumstances of the case, or when the propriety of bleeding from the arm, or of the repetition of such bleeding, admits of dispute, the application of leeches to the side, as advised by Zacutus Lusitanus, Sarcone, Schmucker, and Hufeland, should be resorted to.

157. (*b*) *Emetics* were formerly much resorted to, but they are now but little employed for the cure of pleurisy. They, however, have had the sanction of Riverius, Ruland, Blegny, Mursinna, Morgagni, Wright, Stoll, Tissot, Ackermann, and Schelhammer; and I can add that, when they are discreetly prescribed, they are important aids in the treatment of most of the forms of the disease. They should not be exhibited until after bleeding has been resorted to in the more phlogistic cases. They will often relieve the dyspnœa and oppression attending the stage of effusion, and promote absorption, when judiciously selected and associated with other means which are suited to the circumstances of the case. *Purgatives* are much less beneficial than emetics in this disease. Very active purging is seldom requisite, unless when there are accumulations of excretions and morbid secretions to remove; but it is always necessary freely to promote the secreting and excreting actions of the abdominal viscera. Conformably with this principle, *diuretics* are generally beneficial, especially at an advanced period of the disease, or when effusion has taken place, and when conjoined with cooling diaphoretics or other appropriate measures.

158. (*c*) *Mercurials*, especially calomel, in full or even very large doses in the more acute cases, with antimonials, or opium, or with both, according to circumstances, are often, in this as well as in other inflammations of serous membranes, of the greatest advantage. They have been much recommended by Lind, Wright, Finch, Hamilton, and others, and the experience of recent writers has confirmed the statements of their predecessors. The active exhibition of calomel, either alone or in the combinations now mentioned, is even more necessary in the early stages of pleuritis than in those of pneumonia; and, in the more advanced stages, or when effusion has taken place, either this or some other mercurial preparation, conjoined with diaphoretics or diuretics, and aided by external rubefacients and derivents, is of the greatest benefit. I have often given the bichlorate in small doses, either thus associated, or with other tonics and alteratives, as cinchona, sarza, &c., with marked benefit, at an advanced stage of the disease, and more especially of the latent and asthenic forms.

159. (*d*) *Antimonials* are not so beneficial in pleurisy as in pneumonia, yet they have long possessed a high reputation in the former disease, and have been much confided in by Agricola, Millar, Brocklesby, Belfour, Laennec, and many others. Of these preparations the kermes mineral and tartar emetic have been most employed, although the empirical powder of James and others have also been prescribed with advantage. The kermes mineral was recommended by Von Mertens, Bang, Sims, Montral, Colombier, &c., in doses of one fourth or one third of a grain given every two or three hours, while the tartar emetic was adopted by Callisen, Millar, Belfour, Laennec, and numerous modern writers. Antimonials have rarely been confided in alone for the cure of pleurisy, but have usually been prescribed in aid of vascular depletions, and for the reduction of vascular action and the promotion of perspiration; the substances most beneficially conjoined with them being mercurials, opiates, and other sedatives, or cooling diaphoretics and diuretics, more particularly the solution of the acetate of ammonia, or of the nitrate of potash, and the nitric ether or the spirits of nitric ether.

160. (*e*) Opium and other narcotics have been used by several writers, but generally in combination with other medicines, according to the stage of the disease and circumstances of the case, and with the intention of allaying pain, and of promoting the operation of the substances with which they were conjoined; as with calomel by Hamilton, to determine the constitutional operation of this medicine; with ipecacuanha and nitre by Dover, to determine the diaphoretic action of these substances, or with diuretics to ensure their operation on the kidneys. Opium was much praised by Kortum for pleurisy; and certainly, in conjunction with calomel or other mercurials, and with an antimonial preparation, or in the form of Dover's powder, as I have advised it in other inflammations of serous surfaces, it is of great service, especially after blood-letting in the more phlogistic cases; and with alteratives, or diaphoretics, or mercurials, &c., in the more advanced stages.

161. (*f*) Of other medicines which have been resorted to in pleurisy, there are few which deserve a particular notice. *Camphor* has been much praised by Baglivi, Grimm, Tissot, Gruelmann, and Schelhammer, especially in conjunction with nitre. I have prescribed this medicine very often in the more asthenic forms, and in advanced stages of the more sthenic stages of the disease, and frequently with great benefit, but generally with a mercurial alterative, or other substances, according to the circumstances of the case. *Ammonia* was employed by Chalmers; Hoffmann's *ether*, and other stimulants, by Tissot; and *benzoin* by Hoffmann; but they are serviceable chiefly in asthenic forms and contingent conditions of the

disease. I may add, that *aconite* was recommended by Gebel, in combination with an antimonial medicine for the rheumatic form or complication of the disease, in which form, also, *arnica* was much used by several German writers.

162. (*g*) The *inhalation of warm vapour* was advised for pleurisy by Hippocrates, and of numerous forms of warm, medicated vapours, by modern writers. I, however, much doubt their efficacy, unless as adjuvants, in this disease, in which, as well as in peripneumonia, this practice should not be overlooked, especially in cold and dry states of the atmosphere. In these circumstances of weather and of disease, I have had recourse to it on numerous occasions. In a case attended in 1826, by Dr. T. Gordon, Sir J. Annesley, and myself, the vapour of boiling water was introduced into the apartment, and within the curtains of the bed, by means of a tube leading from a boiler on the fire of the room. As to the use of *medicated vapours*, I need add nothing to what I have stated respecting bronchitis (*see art.* Bronchi, § 98, *et seq.*), as much of what I have there advanced is applicable to pleurisy as well as to pneumonia and bronchitis, and to most of these complications.

163. (*h*) *Demulcent and oleaginous medicines* were very generally employed by both ancient and modern writers, in expectation of obtaining a soothing effect from them as regarded the pain and the cough of pleurisy, and as a vehicle for more active substances. *Linseed oil*, and *decoctions*, and *almond oil*, were chiefly thus prescribed by Sydenham, Lange, Spindler, and others, and were often associated with *camphor*, *opium*, and other sedatives by Gilibert, De Haen, Kortum, and numerous more recent authors. Many other demulcents and mucilaginous preparations have been used, as the *decoctum althææ*, &c., but they require no farther notice at this place.

164. (*i*) Numerous *external means* were advised for pleurisy by most writers, from Hippocrates to this time. *Warm fomentations* of various kinds, and both humid and dry, were much employed; and even *topical cold*, by evaporating lotions, or by means of ice or snow, as advised by Bartholinus, was even resorted to. Of this latter but few modern physicians will form a favourable opinion, although certain analogical facts may be adduced in its favour. *Sinapisms*, and other rubefacient applications to the side affected, were advised by Celsus and others of the ancients, as well as by the Arabian and modern writers; and they are certainly of more or less benefit, according to the knowledge by which a recourse to them is guided. The most beneficial rubefacient, however, which can be employed, the most appropriate to all circumstances of the disease, and the least liable to be injurious in any, is the *spirit of turpentine*, in the form either of epithem, or of liniment, or of embrocation, or conjoined with oil, or camphor, ammonia, and oil with opium; and repeated or renewed according to the effects produced, and to the peculiarities and complications of the case.

165. (*k*) *Vesicants* over the part affected were recommended by Amatus Lusitanus, Conradi, Brocklesby, Gardanne, Grimm, Thomann, De Haen, Tralles, and Engelhart. But they should be prescribed only after bleeding in the more sthenic or phlogistic cases; be large, and repeated even oftener than once in the more chronic states of the disease; and be aided by mercurials, diuretics, and alteratives, according to circumstances. The propriety of applying them over the affected part, especially when there is reason to suppose that the costal pleura is inflamed, and when the patient is thin or emaciated, may be reasonably questioned. In these circumstances, I have generally directed them to be applied, either more or less below the seat of pain, or on the opposite side. In the more asthenic and chronic forms of the disease, a repetition of them, generally in quick succession, in different parts of the thorax, are often of great service, Plummer's pill, with ipecacuanha and opium, being given at night, and small doses of the iodide of potassium and liquor potassæ, with sarsaparilla, being taken during the day. The repeated application of *moxas* to the affected side has been a common practice from the earliest ages in Eastern countries, and has been frequently had recourse to in Europe by modern physicians with considerable advantage in chronic cases of the disease. In these cases, as well as during convalescence from acute attacks, I have often prescribed a large plaster to be kept applied upon the affected side, consisting either of the emplastrum ammoniacum cum hydrargyro, or of a combination of this with the emplastrum picis compositum.

166. ii. Treatment advised by the Author. —The *intentions of cure* are nearly the same for the several forms of pleurisy, although each form requires a more or less marked modification of the plan and of the means by which these intentions are to be fulfilled. The *first* object is to arrest the progress of the inflammation; the *second*, to promote the removal of the products and the consequences of the inflammation; and the *third*, to enable the constitutional powers to resist, in the more chronic cases, the injurious influence of the structural changes produced, and, if possible, to counteract or overcome them.

167. *A.* In sthenic acute Pleurisy, the obvious indication is to arrest the progress of the inflammation by the means recommended for other inflammations of this character affecting other serous tissues, namely, by *blood-letting* to an amount which the age and constitution of the patient, the hardness of the pulse, and the duration of the attack will suggest. If the patient be robust, if the disease has not advanced so far as to give rise to great effusion, and if the pulse be hard and inspiration painful, general bleeding should be promptly resorted to, and carried sufficiently far to relieve the respiration, and to make a decided impression on the pulse, without, however, producing full syncope, for the reasons stated in the article Blood (see § 64, *et seq.*). Contemporaneously, or nearly so, with the blood-letting, a full dose of *calomel*, *antimony*, or *ipecacuanha* and *opium*, should be given, taking care that the dose of the antimony or ipecacuanha should not be such as to occasion vomiting. The effect of these I have so frequently shown to be such as will promote the good effects of vascular depletion, and often prevent the necessity of repeating this measure, that I need not here recur to the subject. If, however, pain on in-

spiration, or when coughing, or hardness of the pulse, should return, blood-letting ought to be repeated, and the other medicines just named again be exhibited after the operation. In some cases, more especially if the patient be not very robust or he not plethoric, *local depletion*, by means of *cupping* a short distance from the spine, or of *leeches* near the part, may be employed *in place* of the second venesection; and, in more robust and plethoric persons, *after* the second blood-letting, if the pulse should rise, and the febrile symptoms increase. The application of leeches should be followed by a succession of warm poultices, or several folds of warm, moist cloths or flannels, covered by dry napkins.

168. It will generally be requisite to give some *purgative medicine*, in order to keep down febrile reaction, and derive the circulation from the seat of disease. But this medicine should not interfere with the effects of those just recommended, and therefore it ought not to be given until some hours afterward; and, during its operation, care should be taken to prevent the free perspiration, usually produced by the medicines previously given, from being checked. The purgative operation may be farther promoted, if it be required, by *enemata*, more especially such as contain the oleum terebinthinæ, or may be left to them alone, particularly when the bowels are not confined. In addition to the means now advised, suitable *diaphoretics* should be given at short intervals. The most generally appropriate are those which consist of the liquor ammoniæ acetatis, spiritus ætheris nitrici, and either the vinum antimonii tartarizati or vinum ipecacuanhæ, with camphor water. To these may be added other medicines, such as digitalis or hyoscyamus, or both, as circumstances may suggest; or a preparation of colchicum may be substituted for the antimony or ipecacuanha, but its operation should be carefully watched.

169. In this form of the disease, and more especially if it have made considerable progress before it came under treatment, the repetition of the calomel with James's powder, or with ipecacuanha and opium, becomes necessary. The frequency of their exhibition should depend upon the dose prescribed and the urgency of the case. I have usually directed full or large doses, particularly of the calomel or opium, at intervals of six, eight, ten, or twelve hours, and the saline medicine, mentioned above, to be taken in the intervals, until the gums indicate a slight affection, or the evacuations assume a green or very dark hue.

170. The above treatment will generally accomplish the first intention, and the latter part of it partly fulfil the second. But it may happen that, when we have happily arrived thus far, exposure to a current of air, or some untoward circumstance, may occasion a *relapse*, or a *recrudescence* of the disease; and the physician will then propose to himself this question, Ought general blood-letting now to be resorted to, or should local depletion be confided in? In this state of the case he will duly consider the amount and effects of the previous vascular depletions, the duration of the disease, and the probable amount of effusion, the existing states of the pulse and of respiration, the pain and other symptoms, in connexion with the age and constitution of the patient, and decide accordingly. But, if a due estimation of all these prevent him from venturing upon general blood-letting, he will decide in favor of the application of leeches, the number varying with the exigencies of the case; and he may even see occasion to repeat them, and to follow them with the warm poultices and fomentations already advised (§ 167).

171. In order to prevent the farther progress of the disease and its consequences, as well as to remove its more immediate results, additional means are often required, more especially after the inflammatory or acute symptoms are reduced. At first the *turpentine epithem* may be applied over the affected side, or folds of warm flannel moistened with this substance, or with embrocations containing a large proportion of it (see Form. 295, *et seq.*). These may even suffice, and prevent the necessity of having recourse to other means; but if they do not produce a decidedly beneficial effect in the course of twenty-four or thirty-six hours, or little more, they should be replaced by a large *blister*, which will generally produce its effects in about six hours, when it should be removed, and the part be covered with a large warm bread-and-water poultice. This ought to be frequently renewed. It will rarely fail to procure a free discharge from the blistered surface.

172. If the disease has made considerable progress, or if the effusion is considerable, it will generally be requisite to keep up a slight mercurial effect on the gums, and to repeat the blister either over or near the part. But in no instance should the blisters, or the vesicating tissues employed in their stead, be applied longer than six or eight hours; they should be then replaced by warm poultices, which will cause them to rise, and prevent the inflammation produced by them from extending below the integuments. In some instances, particularly in those which have proved most obstinate, and when no mercurial effect has been produced, I have directed the blistered surface to be dressed with the mild mercurial ointment, or with this in part, and have generally seen benefit derived from the measure. If the disease be not cured by the above treatment—a contingency which generally arises from some complication or pre-existing affection, or from the advanced progress of the malady before it came under treatment, or from a constitutional vice, as the scrofulous or tubercular—it then assumes the *chronic form*, to which attention will be more particularly directed in the sequel.

173. *B.* The asthenic and the latent States of Pleurisy (§ 47–50) are often advanced to a more or less copious effusion before they come under treatment; and for this reason, and still more from the state of the disease, they rarely admit of general blood-letting, unless they are seen at a very early stage, and the asthenic diathesis is not very prominent. An intimate knowledge of morbid actions, conjoined with close observation and an experienced recourse to remedial agents, can in no circumstances be more advantageously evinced than in the course of treating these and the preceding forms of pleurisy—in determining, in the sthenic, how far to carry, and

how often to repeat, vascular depletion, and in the asthenic and latent as to the propriety of adopting this practice, and as to the manner and the extent of carrying it out when it is determined upon. It should entirely depend upon the state of the pulse, the age and constitution of the patient, and the progress of the disease, whether a moderate blood-letting or leeches be prescribed. Cases may occur when both may be required, and others where neither is admissible, owing to the depression of vital power, and the great amount of fluid effusion which had taken place before the disease had come under treatment.

174. In these states—in those in which vascular depletions have been practiced, as well as in those in which they are inadmissible—recourse should be had, in a prompt and efficient manner, to alterative and diuretic remedies. If the effused fluid be not inferred to be of the puriform character—a state of the effused fluid very rarely observed in an early period, even of the asthenic and latent forms of the malady—calomel should be given, with opium and small quantities of camphor, twice or thrice a day; the infusion of digitalis, with the nitrate of potash, the spiritus ætheris nitrici and oxymel of squills, being taken in the intervals, in doses which the peculiarities of the case will suggest. The digitalis will be more certainly beneficial if it be given at first in as large doses as may be prudently exhibited, each dose, after the second or third, being diminished. The terebinthinate epithem or embrocation should, at the same time, be applied over the affected side, and be renewed according to the effect.

175. In cases of longer duration—when the disease has existed two or three weeks—and when the quantity of fluid effused is considerable, acute or inflammatory symptoms having subsided, the treatment should partly depend upon the means which had already been employed. If the patient he seen for the first time, the internal and external remedies just now mentioned should be resorted to; but if these or similar agents have been employed without avail, the pilula hydrarg. chloridi comp., with the pilula scillæ and digitalis, may be given night and morning, and two or three doses of the iodide of potassium in solution with the spiritus ætheris nitrici, or some other diuretic, in the course of the day. Blisters should not, at the same time, be overlooked; they may be repeated, according to circumstances, in the manner already recommended, in order to obtain their most beneficial effects, and to secure a free discharge from them. They are certainly beneficial, but not to the extent stated by some recent writers. In some instances I have prescribed the *iodide of mercury* internally, with small doses of squills and digitalis, with seeming advantage; and in others directed the *iodide of lead* to be used externally in the form of an ointment, according to the following formula, a small piece of it being well rubbed over the affected side every night, or both night and morning, the side being covered afterward by a piece of flannel:

No. 325. Plumbi Iodidi, ʒj; Unguenti Hydrarg. mitioris et Adipis præpar., ää ʒvj. Misce bene, et fiat unguentum.

176. The effects of iodide of potassium in this disease are very uncertain. In some I have found it very serviceable, in others of doubtful advantage; and in a few I have considered it prejudicial. I have employed it in dropsical diseases of all kinds for very many years, since the time of its first preparation, and can, therefore, say, from considerable experience, that its effects should be carefully observed in the asthenic and latent forms of this disease; for, in some of the more extreme of these, it may prove, as I have found it in two or three cases, distressingly depressing, although given in very small doses. In these cases the iodide of iron, taken in sirup of sarza, may prove more serviceable, especially when aided by the continued application of the emplastrum ammoniaci cum hydrargyro, or by a plaster consisting of equal parts of this, and the emplastrum picis comp. In most cases of the disease, these last means will prove of great service in promoting the absorption of the fluid during early convalescence, or when the fluid is partly removed. At this period change of air—especially to a mild, pure, and dry air, or to the sea-side, in a sheltered situation, and suitable diet and regimen—avoiding vascular excitement, yet sufficiently supporting the powers of life, should always be recommended.

177. It is not unusual to observe, in the more asthenic cases of pleurisy especially, an abundant and rapidly-increasing effusion, occasioning the greatest distress, and even threatening the dissolution of the patient, by its pressure on, and displacement of the lungs, heart, and large vessels, notwithstanding a judicious recourse to internal and external means. When this result is met with, more especially in very delicate or scrofulous persons, or in the asthenic and latent states of the disease, the remedies already noticed having proved inefficacious, no farther time should be lost before recourse be had to *paracentesis thoracis*, to the removal of the fluid through an opening made in the parietes of the chest. It is obvious that, as soon as the medical treatment proves itself inefficacious, this operation should be resorted to, for delay will diminish the chances of success from its performance. As this operation is also required in the chronic states of the disease, more especially for empyema, it will be more particularly noticed hereafter.

178. *C.* Partial and double Pleurisy (§ 51–62) require but little modification of the treatment already advised, which should be adapted to the peculiar features of individual cases. Where the symptoms are acute, and at the same time of the *sthenic* character, the antiphlogistic means should be employed accordingly, and with due reference to each feature of the case. When they partake more of the *asthenic* form, the measures mentioned in connexion with it then are requisite. It may be remarked that, while partial pleurisy more generally presents the former character, double pleurisy commonly possesses most of the latter, and especially requires prompt and efficient treatment, which, however, is in no way different from that which has been already advised.

179. *D.* Chronic Pleurisy and Empyema.—*a.* If the disease have become chronic before treatment has been employed, then the duration of the disease, the amount and probable nature of the effusion, and the urgency of the symptoms will suggest the measures which should be adopted. If the malady have become

chronic, owing to the failure of the means resorted to, or to the constitution of the patient, or to both causes conjoined, as usually observed, the question may still be entertained as to what may be farther tried. In the former circumstances, if the indications above stated (§ 137, *et seq.*) as to the purulent nature of the effusion he not present, and if the duration of the disease have not been above two or three weeks, then the internal and external treatment advised above (§ 174–177) may be tried—promptly and efficiently—before recourse shall be had to *paracentesis thoracis*. If, however, protrusion of the intercostal spaces, hectic and other symptoms indicate a puriform state of the pleural collection, no time should be lost before resorting to this operation. In the latter circumstances referred to, especially when the treatment has been judicious, no appropriate and efficient means having been overlooked, the operation is equally required, whatever may be the nature of the fluid collection, although, perhaps, it may be more urgently called for when indications of a purulent character are present; for where these indications exist no other means will save the patient. The several writers who agree in the propriety of having recourse to this operation—especially LARREY, J. P. FRANK, LAENNEC, FORBES, BELL, ELLIOTSON, WILLIAMS, DAVIS, and H. ROE—advise its performance when the effusion proceeds so rapidly as to threaten the life of the patient, or when it either increases or remains stationary under the use of the means already recommended, although the dyspnœa may not be urgent or the danger immediate, for the continuance of the morbid collection and the compressed state of the lungs may prevent this organ from recovering its functions. Dr. H. ROE justly remarks, that "for empyema paracentesis should always be performed the moment the nature of the case is ascertained. For serous effusions occurring in persons of scrofulous habits, or very delicate health, after pleuritic attacks, for the cure of which the necessary treatment has either failed or been neglected, paracentesis will generally he required." (P. 208.)

180. *b.* There are certain *conditions* requisite to the success of the operation. It is most important that it should be performed before either the vital powers of the patient are too much reduced, or the thoracic viscera have undergone serious organic lesions. It is chiefly when the lung still possesses the power of expanding after the pressure upon it is withdrawn, that a cure can be effected without deformity of the side. If, however, the operation be delayed until the lung has become atrophied, condensed, or bound down by adhesions, so as to be incapable of expanding sufficiently to meet the ribs, either the vacuum will he rapidly refilled with fluid, or the shoulder will be depressed and the side contracted. This last change seldom occurs immediately after an operation, although it takes place gradually, and to a great extent, when the fluid is absorbed. The reaccumulation of the fluid will, therefore, be most likely to occur when the lung is incapable of expanding sufficiently after the operation. When this is the case, a space must necessarily intervene between the surfaces of the pleura, and either the fluid is thereby prevented from being drawn off during the operation, or it is replaced by atmospherio air, which is always injurious to the pleural surfaces, and occasions a more puriform, and often an offensive renewal of the effusion, and the aggravation of both the local and constitutional symptoms, exhausting and ultimately destroying the patient. These consequences sufficiently show the propriety of an early recourse to the operation, but they are not satisfactory reasons for the neglect of it altogether, as urged by those who object to the performance of it.

181. When the operation is performed sufficiently early, even in the most rapid and urgent cases of empyema, the removal of the puriform collection allows the lung to expand, and the upper portions of the pleura to come in contact, and ultimately to adhere; and the adhesion gradually extends as the fluid is removed, until the opposite surfaces become agglutinated; and a cure is thus effected by the obliteration of the cavity throughout, or nearly so. In order to secure this desirable result, it would be most important to determine, were it possible, the exact period when the operation ought to be resorted to—when an operation would prevent the accession of those changes which usually become irremediable. It is manifest that, when indications appear of a puriform state of the collection, no delay should occur; and that, in many cases, it might be of advantage to ascertain, hy means of the exploring needle, the exact nature of the effusion. If it be found that the fluid is serous, then Dr. H. ROE believes that we may wait till the end of the third week, in hopes that medical treatment may cause absorption; and, if it does not, that the operation should not he longer deferred; for he considers, and I think justly, that the operation should not be postponed to a later period, lest organic changes in the thoracic viscera may become irremediable, and that it is, therefore, better that it should be performed too soon, than that this risk should be incurred by delay. Cases are recorded of patients who had been tapped successfully for pleuritic effusions of several months' duration; but there was no proof that the lungs expanded to their full dimensions in those cases, and that the recovery was complete. Dr. ROE states, that no case has occurred to him in which the patient was *perfectly cured* when the operation was delayed until five or six weeks from the commencement of effusion. The non-expansion of the lung in these circumstances has always given rise to the introduction of more or less air into the cavity, in the cases which have come under my observation, however carefully the exclusion of it had been attempted; and the patient has usually sunk from a reaccumulation of a fetid purulent secretion, or survived with a considerable loss of lung.

182. *c.* The *operation* being manifestly necessary, in the circumstances now stated, and its performance not admitting of delay, the *manner* and the *situation* in whicb it is most advantageously performed requires some consideration. The *situation* in which the opening into the chest should be made bas been pointed out by LAENNEC, and it has been generally adopted hy later authorities. He recommends the space between the fifth and sixth ribs, a little behind the digitations of the serratus major, as being the most dependent point in the horizontal po-

sition, generally the freest from adhesion, and the seat of the greatest quantity of fluid. In this situation the operation was performed in all the cases recorded by Dr. H. ROE.

183. The *manner* of performing this operation has recently received due attention. Formerly surgeons advised operations implicating serous surfaces with a perfect indifference to the action of the air upon those surfaces. But the injurious action of the atmospheric air upon serous or shut cavities especially, and indeed upon other surfaces or parts denuded of their epithelia, or separated from their natural connexions, is now acknowledged by every enlightened observer. This is evidenced by the inflammatory irritation, terminating, in weak or unhealthy constitutions particularly, in offensive purulent discharges, and acute hectic fever. Of the *three* following modes of performing *paracentesis thoracis*, the one which should be adopted may be inferred from what I have just stated. According to one plan, an incision is made into an intercostal space, the fluid is evacuated at once, and the wound left open. Another method is to make an opening into the pleural cavity with a trochar, to keep the wound open by introducing a canula, or a catheter, or gum-elastic tube, by which the fluid is to pass off gradually. The third mode consists in making an opening by a trochar or otherwise, and allowing as much of the fluid to flow out as will escape without admitting the air, and in immediately closing the opening. This last method is that which I would recommend, from observation of the results of these several methods, and for the following reasons: *First*. When the air, even in small quantity, comes in contact, either with the pleural surface, or with the false membrane formed on this surface, the state of morhid action and the fluid secreted are still farther removed from the natural and healthy conditions, and rendered more injurious to the economy, and much less capable of restoration to states compatible with the continuance of life. *Secondly*. The continued access of the air will give rise to the thickening of the false membrane, and thereby prevent the lung from expanding, while it will render the secretion at first purulent, and afterward offensive and irritating to the surfaces containing it, and consecutively most contaminating to the circulation and whole frame. *Thirdly*. The operation performed so as to prevent the introduction of the air, although often required to be repeated at successive periods, closing the wound carefully in the intervals, admits of the gradual agglutination of the opposite surfaces of the pleura, does not interfere with the contingent absorption of the remaining fluid, and is compatible with the continued recourse to medical treatment appropriately to the peculiar features of the case.

184. I agree so entirely with what Dr. WILLIAMS has stated as to the manner in which this operation should be performed, that I here adopt his recommendation: "The spot for the introduction of the trocar should he determined with due reference to the physical signs; carefully avoiding every part where, or near which there is sound of respiration, voice, or not perfect dulness on percussion. A projection or fluctuation of an intercostal space give greater eligibility to a spot; and these circumstances present themselves most frequently at the inferior lateral parts of the chest, from the third to the seventh rib, where, also, the soft walls of the chest are as thin as anywhere. In all cases it is a proper precaution to pass a grooved needle first, as recommended by Dr. T. DAVIES; for this at once determines the pressure of the fluid, its quality, and the thickness of the walls which contain it at that spot." The upper margin of the fifth or sixth rib offers most commonly the most favourable situation, avoiding, of course, the immediate vicinity of the known arteries and nerves, and especially of the heart, with reference to displacement, &c. "The patient should be lying on his back, inclining to the affected side, and not more raised than is necessary to the state of his breathing. The skin should be drawn aside, so that the puncture through it may not, after the trocar is withdrawn, correspond with that of the pleura, but form a valvular orifice. The trocar should not he pushed in farther than is necessary to clear the parietes, but the canula may be pushed farther after the stilette is withdrawn, and its sides should have several holes in them. As soon as the stilette is withdrawn, steady pressure should be applied by a bandage, or hy the hands of an assistant, to depress the shoulder and sides, and to push up the diaphragm on the affected side to promote the flow of liquid, and to prevent the introduction of air through the orifiee during any sudden or forcihle act of inspiration. For the same reason, during a fit of coughing, if there appear any tendency to intermission in the stream of fluid, the orifice should be closed by the finger. The pressure should be steadily increased as the liquid flows; and if the stream should stop, a probe may he passed through the canula, to clear it of clots of lymph or other obstructing matter; hut if still no more flows, a compress, or, if the liquid is purulent, a large poultice shonld be placed on the orifice; and then, and not till then, the pressure on the walls of the chest may be discontinued. The result will be, that the walls of the chest, expanding by their own elasticity on the removal of the pressure, will draw air into the compressed lung, which, being thus inflated, will begin to resume its part in the function of respiration and circulation, and will thus promote the absorption of the rest of the fluid, and improve the condition of the whole system. Even if the fluid should reaccumulate, the temporary expansion of the lung will have served to restore its natural properties, so that, when another quantity of fluid is again withdrawn, the organ will he better prepared for a restoration of its functions." (P. 28.)

185. Performed in the manner thus judiciously advised by Dr. WILLIAMS, the operation is free from risk, and will seldom fail to give relief. If the collection be purulent, it will often he necessary to repeat the operation several times; but if it be serous, one tapping, which will more or less expand the lung, will often be sufficient to give a turn to the disease, the complete removal of the effused fluid being effected hy nature, aided hy appropriate remedies. When the fluid is purulent, Dr. WILLIAMS recommends the injection of warm water with the view of displacing it; but, instead of doing this with a single tube, it should be done

through a double-tubed canula, the tube for injection being cautiously carried two or three inches into the chest, while the evacuating tube is merely long enough to pass through the walls. If warm distilled water be then thrown in by a syringe through the longer tube, it will drive the matter off through the shorter tube, and in this way the morbid secretion will be displaced by water, which is much more likely to be absorbed. If, after repeated evacuations, there be no apparent disposition to the expansion of the lung or contraction of the chest, and matter continues to be secreted, the writer now quoted advises a recourse to medicated injections, "such as a very weak solution of nitrate of silver, or chloride of soda." I have no experience of medicated injections in these circumstances; but I see no reason against a cautious recourse to them. The pleural sac may be treated, in these cases, as an abscess; and, if the discharge be unhealthy, we should endeavour to correct it, and to promote the healing of the diseased surface by such means as are found beneficial in analogous circumstances. When the discharge is fetid, it may be washed out, in the way just advised, by antiseptic injections, especially by chlorinated solutions, or fluids containing creasote. "The same practice may be advantageously pursued when the matter has pointed, and opened spontaneously, leaving a fistula which may remain open for months, or even years. Dr. Townsend mentions the remarkable case of Dr. Wandelstadt, who had been tapped thirteen years before, since which time the wound had remained open, and discharged daily from half a drachm to four ounces. The diseased side was much contracted, and did not move on breathing, yet he could blow the flute, walk fast, and actively perform his professional duties."

186. I believe that the Hippocratic method of evacuating the fluid at successive times, preventing the access of air, and closing the orifice in the intervals, is the best, because it gives the lungs time to expand, and prevents those changes in the inflamed membranes, and in the products of inflammation still retained in the pleura, that the admission of air would certainly produce. The practice of leaving the orifice open, and especially of leaving a canula in it, is attended by this mischief, namely, that the free access of air to the cavity either rekindles the inflammation of the pleura, of which the effusion had in great measure caused the resolution, or changes the character of the inflammation still remaining from an adhesive to a suppurating form, and ultimately even decomposes the matter which is formed. I have generally observed, when the access of air was allowed, that the fetor of the discharge was most manifest in two or three days, and that all the constitutional, and even the local, symptoms were aggravated.

187. Several recent writers, who have advocated the propriety of operating in the circumstances already stated, have not sufficiently recognised the importance of excluding the air, and have considered that, because it has been shown by the experiments of Nysten and others that air introduced into the cavity of the healthy pleura is removed in a short time by absorption without manifest detriment, no injury need be expected from its admission after this operation. But circumstances are different as regards these experiments and the operation for this disease; besides, what has been inferred from *à priori* reasoning and from analogy has been proved by the experience of several candid observers, namely, that, although air may not affect a serous surface, when only temporarily brought in contact with this surface, it will certainly influence it, if allowed free communication with it; that, when this surface is inflamed already, the admission of air aggravates, and changes to an unfavourable form that inflammation; and that the air acts also injuriously upon the products of inflammation, both the consistent and fluid; changes their characters, decomposes them, and renders them more contaminating to the surrounding tissues. To prevent the injurious influence of air, it has been recommended to perform the operation under water, and while the patient is immersed in a warm bath. In certain circumstances, and more especially in the more prolonged cases, this expedient deserves attention, and even adoption.

188. Some writers have advised fluid injections into the pleural cavity, with the view of expelling both the diseased effusion and the air which may have been introduced; and it is not improbable that pure or distilled water, of the proper temperature, thus introduced, the orifice being accurately closed afterward, may have a beneficial effect, and be absorbed, although the morbid fluid was not absorbed, owing to its nature. If this measure were adopted, it should be employed in such a manner as to wash out the morbid matter as entirely as possible; and the fluid allowed to remain should not be so much as might prevent the lung from expanding, if it still possessed this power. Of the success of medicated injections in these cases, the evidence is not sufficiently conclusive. Dr. Williams states that Sir P. Crampton used with success an injection of a weak solution of chloride of lime; but all stimulating injection must necessarily increase or perpetuate the inflammatory action in the surface, and thereby prove an obstacle to the expansion of the lung, and to the attainment of the end proposed by the injection, namely, the arrest of the effusion and the adhesion of the opposite surfaces. In some instances, however, the injurious effect may not result, while the beneficial effects may follow; and, therefore, such injections may be cautiously resorted to after other means have failed, and in the circumstances hereafter to be noticed (§ 189). In this state of the disease, and on occasions which the experienced physician will duly appreciate, he will agree with Celsus in considering that the "Anceps remedium melius est quam nullum."

189. In order to obtain the re-expansion of the lung, so much to be desired after the operation for empyema, and at the same time to increase the discharge of the accumulated fluid, it has been advised by Laennec and others to apply a cupping-glass with an exhausting syringe over the puncture. Some advantage might accrue from this expedient, if carefully performed; but it is not unattended by risk, both from injuring the lung by forcibly expanding it, and from allowing air to rush in through the opening upon removing the exhausting apparatus.

If these dangers could be sufficiently guarded against, the expedient might prove of service. The latter might be prevented, and the former could hardly be considered so great as to prevent a cautious recourse to it.

190. *D.* The Complications of Pleurisy necessarily involve the same principles of treatment as have been above developed.—(*a*) The most frequent complication, namely, that with *pneumonia*, forming *pleuro-pneumonia* (§ 93, 148, *et seq.*), requires very nearly the same treatment as I have recommended for either of the diseases when occurring simply; due regard being paid to the existing diathesis or states of vascular reaction and vital resistance. In this complication, however, and more especially when the sthenic character is manifest, the preparations of *antimony*, especially tartar emetic, are more frequently beneficial than in uncomplicated pleurisy; but they should be exhibited after blood-letting, and in the manner advised for pneumonia (*see* Lungs, Inflammation of, § 96), or in conjunction with calomel and opium, as above prescribed (§ 167, 169); the other internal and external means advised for these maladies being employed as the circumstances of the case will suggest.

191. (*b*) When pleurisy complicates *eruptive* or *continued fevers* (§ 94), then the treatment must necessarily depend upon, 1st. The character or state of the fever; 2d. The period of the fever at which it occurs; and, 3d. The states of vital energy and vascular action characterising it. In these complications, the *asthenic* diathesis should generally be suspected, unless the character of the prevailing epidemic constitution and of the existing symptoms indicate the contrary, and the plan of cure suggested above for the asthenic or cachectic forms of pleurisy (§ 47, *et seq.*) ought therefore to be entertained, with such modification as the features of individual cases may require. It very frequently happens that the local disease is either not detected in these circumstances, or proceeds so insidiously and latently as to elude even close observation, until it has advanced far, or given rise to considerable effusion, and can admit only of the curative means which have been already recommended for the latent, the advanced, or the chronic states of the malady, as the case may be (§ 173, *et seq.*). In these complications I have seen great advantage derived from the terebinthinated epithems or embrocations, and the other external remedies mentioned above (§ 171, 175).

192 (*c*) The partial, adhesive, and chronic states of pleurisy which so generally complicate the advanced stages of *tubercular consumption* (§ 95) fall more legitimately under the treatment of that malady; but I may here remark, that the pleurisy which thus supervenes is not always attended by tubercular deposits, either upon the pleura or in the false membrane; although it is sometimes thus accompanied, more especially in the scrofulous diathesis, and in persons who have been exposed to depressing agents, as anxiety of mind, insufficient nourishment and clothing, and deprivation of air, exercise, and sunshine. In these circumstances, also, pericarditis may farther complicate the malady and present a tubercular character (§ 96). In both these forms of complication the friction sound is often heard on auscultation, and then the nature of the mischief may be inferred with tolerable certainty, especially in the circumstances just stated. The treatment cannot be expected to be satisfactory in these cases, some of which are attended by either more or less anæmia or cachexia; but life may be prolonged for a very considerable period, even if it may not be saved, by a judicious recourse to chalybeate preparations, more especially to the iodide of iron with sarza, alternating this course with very minute doses of the bi-chloride of mercury, prescribed in tonic decoctions or tinctures, &c.

193. (*d*) In the complication of pleurisy with *hepatitis* (§ 98), and in that with *peritonitis* (§ 99, 100), the associated malady usually presents an acute character, which may pass into the chronic form if not promptly and actively treated. In these complicated states of disease, the means which are most serviceable are not materially different from those advised for the acute form of either of these uncomplicated diseases. It is generally of great importance to bring the system under the influence of mercury before effusion takes place or proceeds far; and this may be done by either the internal or the external use of the mineral, or by both modes, according to circumstances. In a case of remarkable urgency, to which I was recently called, a large blister was applied somewhat below the seat of suffering, after blood-letting was carried as far as appeared prudent; free vesication was promoted by warm poultices; and, after the cuticle was removed, the mild mercurial ointment was applied, and covered by a warm bread-and-water poultice. The most beneficial results were soon afterward observed, and the patient rapidly recovered. In these complications, the terebinthinate epithems and embrocation, advised above (§ 171), are often of great service, when judiciously employed and aided by the additional means which the state of the case will suggest.

194. In some of the complications of pleurisy just noticed, *paracentesis thoracis* can furnish only temporary relief; in others it may be most beneficial, while in a few it cannot be attempted with any sufficient prospect of advantage. It is not merely the complication which ought to be considered, but also every circumstance connected with the case, and more especially those connected with the primary malady, of which the pleuritic attack is the consequence. When this operation appears at all admissible in any of these associations, it should be resorted to as early as possible; for the several lesions mentioned above (§ 101) may soon be caused by the pressure of the effused fluid, and farther complicate a disease which an operation promptly performed might have removed.

195. *E.* In the Dark Races (§ 102) pleurisy should be treated as I have advised for the asthenic and complicated forms already considered. Whether it assumes an *acute* or a *chronic* character in these races, I have always seen it more or less latent, complicated, and consecutive, more especially of tubercles of the lungs; tubercles having been found also on the surface of, or below the pleura, or in the false membranes after death (§ 102). When the effusion is great, paracentesis should be early employed. The few cases of this disease which I have seen in these races have not been so much

benefited by treatment as the natives of cold or temperate climates; but this was partly attributed to the unfavourable circumstances in which they were placed, and to the influence of a temperature and climate different from that to which they are suited by their organization.

196. *F.* Pleurisy in Infants and Children (§ 103) requires the same measures as I have advised for adults, due reference being had to age and to the susceptibility of the influence of certain remedies connected with infancy. In this class of subjects, pleurisy is most frequently consecutive and complicated, and the treatment should be prescribed accordingly. For very young children especially, some remedies which are most beneficial for adults with this disease should either not be employed at all, or with great caution. The chief of these are opium and other narcotics, tartar emetic, and blisters; but calomel may be given freely without risk, with small doses of James's powder, vascular depletions being promptly employed, and to an extent which the circumstances of the case will warrant. The terebinthinate epithem or embrocation will prove of great service, and will be attended by no risk, unless the utmost neglect be evinced. If the application of a blister be considered advisable, with the view of obtaining a discharge from the external parietes of the chest, it should not be continued longer than three or four hours, or until slight redness of the surface is caused by it, when a warm bread-and-water poultice should be applied, which will usually produce vesication without subsequent risk, if due attention be paid to the case.

197. In the acute stage of the malady, the treatment now advised, aided by diaphoretics and diuretics, should mainly be trusted to; but, as the chronic stage advances, and particularly as effusion increases, the iodide of potassium may be prescribed, with liquor potassæ and some preparation of sarza, or with the addition also of a diuretic; the terebinthinate liniment, or a liniment containing the iodine of lead, or iodine of potassium, being occasionally applied to the side, or the emplastrum ammoniaci cum hydrargyro, or equal parts of this plaster and of the emplastrum picis comp. If the patient evince a marked debility, or cachexia, anæmia, or constitutional vice in the chronic stage, the iodide of iron should be given in the sirup of sarza, and change of air, especially to the sea-side, be recommended; the external applications just mentioned, or the frequent sponging of the surface with warm salt-water, or with a tolerably strong solution of bay-salt in warm water, or the use of these alternately, being also resorted to. If effusion be considerable, especially if the patient live in a large town, change of air to the country, aided by suitable alterative and diuretic medicine, will generally remove the disease, unless it have become complicated, or the vital powers be very depressed, and the constitution cachectic.

198. Treatment, judiciously directed, is generally much more efficacious in this class of patients than in persons advanced in age, or even in adults; and the more serious consequences of the disease, as empyema, with or without fistulous opening, should not be considered hopeless, unless complicated disorganization exists. Whenever the effusion appears to be puriform, no delay in resorting to paracentesis thoracis should take place in children, more than in adults; and in the former especially, it is hardly ever too late to perform this operation, particularly when the effusion is of this kind.

199. iii. Diet and Regimen.—It is almost unnecessary to add anything on this topic, as it must be evident that both the diet and the regimen should be strictly antiphlogistic during the acute stage, more especially when the disease presents a sthenic character. As effusion advances, or becomes chronic, and especially if vital resistance be weak, it will often be necessary to support the powers of life with such means as will the least excite vascular action or accelerate respiration, and at the same time tend to increase the natural secretions and excretions. This becomes the more requisite in the scrofulous diathesis, or when the effusion is puriform, and attempts to discharge and prevent the return of the effusion are being made. But there is no aid to a judicious treatment that deserves more general adoption than change of climate, especially to the sea-side, to a mild air, and to a dry situation. A person who is recovering from pleurisy should guard, both during convalescence and for a long time afterward, against currents of cold air; against wet, cold, or damp feet; and against errors in diet; and he ought more especially to avoid standing upon cold stones, or floor-cloth, or in damp places. His shoes ought also to be changed after walking, immediately upon returning home.

200. XII. Structural Changes of the Pleura not necessarily arising from Inflammation.

Classif.—IV. Class. II. Order. (*Author in Preface.*)

1. Defin.—*Lesions of the pleura not necessarily depending upon, although frequently associated with, inflammatory action, but often arising from diathesis, or constitutional vice or contamination, and seldom attended by distinct signs, although their presence sometimes may be inferred from the history of the case, and from various local and general symptoms.*

201. i. Description.—I have so fully described those lesions of the pleura resulting from inflammation (§ 112, *et seq.*), that I cannot farther advert to them than to briefly notice some of their associations with those alterations about to be considered. Certain lesions which I shall point out doubtless originate, in most cases, if not in all, in inflammatory action; but they subsequently undergo changes, which may be referred to morbid nutrition, this nutrition giving rise either *to a transformation of the tissue to one of a different nature; to the transition of this tissue to another different from it, but not foreign to the economy, or to the production of a structure altogether adventitious to the healthy frame.* It is thus that we perceive, as a consequence of pleuritis, and owing to the states and grades of action, and to the conditions of the constitution, cartilaginous or ossific deposits or transformations of the pleura in some cases; and, in the course of this disease, owing to constitutional vice, tubercular deposits either beneath the pleura, or in the albuminous or fibrinous deposits, or false membranes on the free surface of this membrane. The former le-

sions most probably originate in inflammatory action or irritation, the morbid nutrition proceeding as this action subsides; but the latter lesion is either coetaneous with the inflammation, or excites it, or is a consequence of it, in the scrofulous or tubercular diathesis. The lesions more immediately as well as remotely consequent upon inflammation of the pleura have been described above (§ 112, *et seq.*), with the exception of *gangrene*, *ulceration*, and *perforation* of this membrane, of which I proceed to take farther notice.

202. *A. Gangrene of the pleura* occurs only on very rare occasions, and chiefly as a consequence of either gangrene of the subjacent lung, or abscess of this organ, or external to the costal pleura. A sphacelated state of the pleura may also occur in an advanced stage of chronic pleurisy or empyema in the form of gangrenous ulcers, as remarked by Laennec, Baron, and Chomel, but this is very rare. Gangrene of the pleura is generally limited to a small space, and presents the appearances of irregular patches of a brownish green, livid, or very dark hue, that softens, ulcerates, and passes into a dark-grayish, dirty, and irregular surface, exhaling a fetid odour. Around these patches, indications of inflammatory action, with certain of the more usual consequences of this action, are generally observed.

203. *B. Ulceration and perforation of the pleura* are not infrequently met with, and are noticed, especially as regards their chief consequences, under the head of chronic pleurisy, and in the article Pneumathorax. They may take place under a variety of circumstances, especially when they commence, as more frequently is the case, in the attacked surface of the pleura, perforation proceeding from this surface inward. In cases of abscess, or of tubercular softening and ulceration, or of gangrene of a superficial portion of the lung, softening and ulceration of the pleura covering this portion thus supervene, and sometimes go on to perforation. Hæmorrhage from injury or disease of a blood-vessel, or pulmonary apoplexy, may cause rupture of the pleura at the nearest point to the seat of effusion. Either ulceration or perforation, or rupture of the pleura, may likewise be caused by abscess seated in some place external to this membrane, as an abscess of the lungs, liver, &c.; or by hydatids, cysts, tumours, aneurisms, and injuries of any adjoining structure or part. In all these circumstances the perforation commences in the attacked surface, and advances into the pleural cavity; but it may proceed from within outward; but this is very rarely the case unless in general or partial empyema, when the matter is evacuated either through the lungs or at some part of the thoracic parietes, as already described (§ 87–92).

204. *C. Effusions into the Cavity of the Pleura.*—Those which depend chiefly on inflammatory action have been described above (§ 115, *et seq.*), and have been shown to consist of serous, sero-albuminous, or plastic products, which may undergo various changes of puriform matter, and more rarely of a sanguineous or sero-sanguineous fluid. Those which take place independently of inflammation are simple serous or watery effusive hæmorrhages, and the passage, owing generally to perforation or rupture of the pleura, of gaseous fluids, or of purulent, gangrenous, tuberculous, or cancerous matters into the cavity.

205. (*a*) *Watery effusions*, or *passive serous effusions*, require no farther notice than they have already received when treating of *dropsy* of the pleural cavity, they being usually independent of disease of the pleura itself (*see art.* Dropsy, § 158, *et seq.*).

206. (*b*) *Hæmorrhagic effusions* into this cavity, or *hæmathorax*, may proceed from a hæmorrhagic form of inflammatory action implicating this membrane, characterized by deficient vital powers and a morbid state of the blood itself; or from loss of tone of this surface and of the capillaries ramified to it; or from this state conjoined with an hæmorrhagic tendency, or from rupture of an aneurism, or injury or disease of some vessel adjoining or involving the pleura. In the former states, the effusion, whether altogether sanguineous, which is very rarely the case, or sanguineo-serous, is an exudation from a greater or less extent of the pleural surface, this surface being more or less concerned in causing the effusion. In the latter this surface is generally healthy, the blood-vessels subjacent or adjoining it being principally affected. When blood is effused into the cavity of the pleura, inflammation is usually thereby produced; and generally with a rapidity according to the quantity and purity of the blood effused, the resulting phenomena varying with the condition of the patient and circumstances in which he is placed.

207. (*c*) The effusion of *gaseous fluids* into the cavity of the pleura is considered in the article Pneumathorax, and of *purulent collections* I have already treated. *Tubercular* and *cancerous productions* often form within the pleura, but they also appear external to it, as well as involve its structure, as will be shown in the sequel. The passage of gangrenous, carious, ichorous, or other morbid products, from disorganization of an adjoining part into the cavity of the pleura, may likewise occur in the manner already stated; but, when this takes place, inflammation is thereby rapidly exerted throughout the serous surface. Simple *cysts* and *hydatids* are rarely or never formed within the pleural cavity, and are rarely developed externally to it, or, at least, in such situations as allow them to find their way into this cavity.

208. *D. Cartilaginous and osseous formations*, or transformations of the pleura, are not very rarely met with. In some instances these changes appear to exist immediately under or external to the pleura, or on its attacked surface, the membrane retaining its natural structure and polished surface. In others they seem more entirely to involve the pleura, as if arising from thickening and induration of this tissue, and advancing through the fibro-cartilaginous state to osseous transformation; and in some cases they are confined entirely, or in part, to the false membranes or adhesions formed on or between the pleural surfaces. They evidently result, as noticed above (§ 201), from a state of chronic inflammation or irritation that has passed into morbid nutrition, the fibro-cartilaginous condition being intermediate between simple thickening with induration and ossification. They have been found of various grades of thickness, from a line or two to an inch, and seated in or upon either the costal, the dia-

phragmatic, or the pulmonary pleura, and in some cases in the false membranes existing between and connecting these. In some instances the transformation is neither altogether cartilaginous nor entirely osseous, bony matter, in lamellæ, or in irregular forms, and in detached patches, existing between the layers of cartilage, or otherwise irregularly deposited.

209. These productions are found either in the form of smooth plates or lamellæ, or in that of irregular nodules, or they present a rough surface, with irregular acuminations or points. They are never met with to any considerable extent in connexion with the pulmonary pleura, without the subjacent lung being more or less consolidated. In rare instances, they have assumed a rounded, oval, or globular form, either with bases of varying sizes, or with narrow and short peduncules, their surfaces being smooth and shining, as if still covered by the pleura. These nodules may be single, or several may exist in the same case, their magnitude varying from that of a pea to that of a large cherry.

210. *E. Fatty appendages* have been found attached to the free surface of the pleura, but very rarely, at least entirely unconnected with adhesions between the opposite surfaces. I have met with these appendages in several cases, but in all they appear to have been developed by the formation of fat underneath a portion of false membrane, and between it and the pleura, the false membrane having been of old date. In some cases, old adhesions, having a polished serous surface, and a thick or rounded form, have consisted, excepting their surfaces, entirely of fat.

211. *F. Tubercles* may be formed either on the attached surfaces of the pleura in the subserous cellular tissue, or in the pleural cavity. In the former situation they chiefly consist of numerous small granulations under the pulmonary pleura; and sometimes they form more considerable masses developed beneath the costal pleura, and causing elevations of the pleural surface. Tubercles are never found within the pleural cavity, unless in connexion with false membranes or adhesions, and infiltrating or studding these, as described above (§ 120), thus constituting the *tubercular form of pleurisy*. But they may exist in both situations in the same case, as well as in the lungs and adjoining membranes, as the pericardium, peritoneum, &c. Tubercles may be formed underneath or upon the attached surface of the pleura, as just described, and may advance even farther in their development without any evidence of inflammatory action in their seats or vicinity. But the circumstance of their constant coexistence with certain of the products of inflammation, when they are found within the pleural cavity, or upon the free or internal surface of the pleura, suggests the question, whether they are the *cause* or the *result* of inflammation in the tubercular diathesis. That they are merely one of the products of inflammation in this diathesis, are exuded, in a rudimental state, with the lymph produced by the inflammation, and are further developed as the organization and other changes of that lymph advance, are circumstances rendered probable by their constant coexistence with these products; while the opposite doctrine, that they are the causes of the inflammation, and of the consequent exudation of lymph in which they are enveloped, necessarily allows that they are first thrown out or formed upon the free serous surface, where they excite the irritation and inflammation, with its consequences found in connexion with them. Now if they are thus formed on the free serous surface, before inflammation is developed, it is reasonable to infer that they should be found, in some instances, before this effect is produced, or produced to an extent rendering the cause doubtful; but this has hitherto not been remarked (*see* § 120).

212. *G. The several forms of malignant* or *cancerous degenerations* have been observed involving the pleura, but generally consecutively, never primarily. These lesions, whether schirrous, carcinomatous, encephaloid, or fungo-hæmatoid, when they implicate the pleura, are consequent upon their existence in some other part of the economy, most frequently in the mamma, in the axillary glands, or in some other situation in the vicinity. They first extend to the subjacent cellular tissue, causing an irregular thickening and induration, with their characteristic forms of degeneration of this tissue, and an irregularity or unevenness of the serous surface, which ultimately becomes variously changed in color and consistence, according to the form and progress of the malady, until it altogether loses its natural hue, and is altogether involved in the malignant structure. At this advanced stage the surface and cavity of the pleura generally present more or less of a turbid, dirty, ichorous, or sero-sanguineous fluid, which is sometimes also offensive, or of a peculiar odour.

313. ii. Symptoms and Signs of Structural Change of the Pleura.—The *symptoms* and *signs* of these changes are mostly the same as have been described above as indicating the progress and advanced stages of inflammation of this membrane. Those changes, which are essentially the result of inflammation, most necessarily present these symptoms and signs which, in connexion with the history of the case, usually show the nature, if not always the exact extent, of the disease. But those lesions which consist of adventitious formations, as regards either the situation or the economy, frequently advance without any distinct symptom or sign from which their existence may be inferred.

214. (*a*) *Gangrene of the pleura* (§ 202) being met with chiefly as a consequence of gangrene of a portion of the lung, is preceded by the indications of this occurrence. When the symptoms of gangrene of the lungs (*see* Lungs, § 173–175) are followed by an acute pain in the side, painful cough and inspiration, extreme anxiety and depression, followed generally by all the usual symptoms of the utmost vital exhaustion, then this lesion may be inferred. The physical signs may consist merely of dulness in percussion, of greater or less extent, with absence of the respiratory sound.

215. (*b*) *Ulceration of the pleura* (§ 203) is announced only when it has terminated in *perforation*. If the ulceration has proceeded from the attached surface into the cavity of the pleura, the passage of the matters, whether gangrenous, puriform, tuberculous, aëriform, &c., the patient very suddenly experiences

acute pain in the side, with oppression, dyspnœa, and anxiety; and if air passes rapidly into the pleural cavity, these latter symptoms are not only sudden, but also extreme, and are attended by the physical signs of *pneumathorax*. When ulceration, followed by perforation, takes an opposite course, proceeding from the internal cavity externally, as stated above (§ 203), then the symptoms already described (§ 87, *et seq.*) as attending *empyema*, when terminating in this way, are usually observed.

216. (*c*) *Acute or inflammatory effusions into the pleural cavity* have been already fully noticed (§ 204–207) as respects the symptoms and signs they produce, and passive effusions into this cavity have been elsewhere treated of (*see art.* Dropsy, § 158, *et seq.*). Effusion of blood into this cavity, *hæmathorax*, unless when it occurs from rupture of an aneurism, or from external injury, is a rare occurrence, as shown when treating of hæmorrhage into the pleural cavity (*see art.* Hæmorrhage, § 277). As a pure exudation in this situation, it is very rarely met with, although the exhalation of a greater or less proportion of red particles with the serum of the blood, in some extreme cases of asthenic acute pleurisy, or of cachectic pleurisy, is not very infrequent, and constitutes the *hæmorrhagic pleurisy* of Laennec. *Hæmathorax*—or the effusion of blood into the pleural cavity, analogous to the hæmorrhages, active or passive, of other organs or surfaces—is so rare, that the phenomena attending or consequent upon it have not been satisfactorily observed, and they are hence imperfectly described. But, whether the blood poured out in this situation be a primary lesion, or consecutive of some other, or of local injury, I cannot view it, with M. Laennec, as an occurrence devoid of importance, as regards its effects upon the pleural cavity, or believe that the blood effused in this situation will be absorbed without producing inflammation in this cavity. My experience has proved that, although absorption does take place, inflammatory action, varying in character and intensity with the circumstances of the patient, is the most frequent result, as I have already shown (§ 206). It must be admitted that effusion of blood into the pleura will produce similar *symptoms* to those resulting from other effusions to the same amount. But it will be generally observed that indications—either local or constitutional, or both—of inflammatory action of the pleura will sooner or later supervene; and that the products of this inflammation, mingled with altered and nearly absorbed blood in the pleural cavity, will give rise to peculiar appearances, on examination after death, more distinctive of the immediately antecedent inflammation, than of the hæmorrhage which developed the inflammation. I have nothing to add at this place to what I have stated above respecting the symptoms and signs of purulent or of other effusion into the pleura (§ 63, *et seq.*), and have advanced in the *art.* Pneumathorax, when noticing the combination of aëriform and fluid effusions into this cavity.

217. (*d*) *Cartilaginous* and *ossific formations* in the pleura are not indicated by symptoms or signs during life. They are merely contingent changes, occurring after chronic pleurisy, and are met with chiefly in persons who have lived for a considerable time after such attacks, with more or less disorder of the respiratory functions, and probably with dulness on percussion, or with imperfect or absent respiratory murmur; and although their existence may possibly be in some instances suspected during life, they are unattended by any peculiar symptom or indication.

218. (*e*) *Tubercles* formed immediately beneath the pleura, occasioning small or irregular elevations of the membrane (§ 211), without much effusion, are generally attended by a rubbing sound during respiration; but if effusion exist, or if the tubercles be deposited in false membranes, their presence can be suspected only, and chiefly from the coexistence of the pleuritic lesion with tubercular consumption, or from the occurrence of this lesion in the scrofulous diathesis. Tubercular formations are most frequently found in one side only, in the same case, but they may exist in both cavities; and they may be present in both the pleura and in the pericardium. When this latter complication occurs, without much effusion within the pericardium, there is generally a cardiac rubbing sound in connexion with a similar sound during respiration.

219. (*f*) *Cancerous or malignant alterations* in the pleura may be inferred from the gradual, nearly latent, and chronic or sub-acute form, in which the pleuritic affection supervenes upon malignant diseases of the mamma, or in the vicinity of the thorax; and from the presence of symptoms and physical signs similar to those attending tubercular formations in this membrane. The rubbing sound generally continues for a considerable period, and until the subsequent effusion becomes copious; and the pleuritic symptoms appear chiefly when the cachexia attending the cancerous malady is well marked, and the system manifests more or less of the usual accompanying anæmia.

220. iii. Treatment.—The treatment of the organic lesions of the pleura now passed under review, should be directed entirely by the circumstances of the case, and by the evidence furnished of their individual existence, and of their morbid associations.—(*a*) If there be reason to infer the supervention of *gangrene* of this membrane, treatment is then very rarely of any farther avail than to prolong existence for a few hours, or at most a day or two; and this object can be attained only by the exhibition of restoratives, &c., as camphor, ammonia, quinine, myrrh, ammoniacum, &c.; for, although recovery from gangrene of the substance of the lungs may take place by the aid of these or similar means, it is very rarely procured when this lesion has extended to the pleura.

221. (*b*) As to the treatment of *ulceration and perforation* of, and *effusions* into, the pleura, I can add nothing to what I have recommended to be done for the more advanced stages, and more chronic forms of pleurisy (§ 63, *et seq.*), for which, however, and more especially for the more simple states of effusion, the means there advised, when judiciously administered, will be often very successfully employed, especially when aided by a free use of the acetate of potash, so as to act manifestly both upon the bowels and kidneys; and by the external means above mentioned (§ 175, *et seq.*). If the causes and circumstances of the disease lead to the

inference that much *blood* is effused into the pleural cavity, or that this fluid constitutes the larger part of the effusion, I believe that the operation for empyema should not be delayed, otherwise inflammation, if it have not already appeared, will certainly supervene, in a form not readily removed by treatment, inasmuch as the blood, or at least its unabsorbed portion, will remain to perpetuate the disease, and favour the occurrence of consecutive lesions.

222. (*c*) The treatment of the *other organic lesions* of the pleura promises but few advantages when their presence are even presumed. *Tubercles* are very rarely present in this membrane, without existing in still greater abundance, and often in advanced states, in the lungs or other structures. Hence the treatment requires to be directed in many cases more to these organs than to this special lesion; and, even when the features of the case warrant the direction of remedies principally to this seat of disease, it will be difficult to suggest to others more likely to be beneficial than those advised above for chronic pleurisy (§ 175–179). The mistura ferri composita, the iodide of potassium, the iodide of iron, the liquor potassæ with tonic infusions and sarsaparilla, or these variously combined, or conjoined with such other substances as the peculiar circumstances of the case will suggest, are most generally appropriate for these lesions, as well as for the effusions into the pleural cavity, by which these lesions are often attended, especially when aided by suitable means for the promotion of the alimentary and renal evacuations, and by external derivatives.

Bibliog. and Refer.—*Hippocrates*, Περι Τοπων, &c., Opera, p. 414; et Περι των Εντος Παθων, Op., p. 515, 534. —*Galen*, De Loc. Affect., l. v., ch. 3.—*Celsus*, l. iv., ch. 6. —*Aretæus*, Cur. Acut., l. i., ch. 10.—*Aëtius*, viii., 76.—*Alexander Tral.*, vi. i.—*Oribasius*, Synopsis, &c., ix, 7, S. —*Actuarius*, Method. Med., iv., 4.—*Cœlius Aurelianus*, Morb. Acut., l. ii., 13.—*Octavius Horatianus*, ii., 4.—*Marcellus*, De Medicam., 24.—*Serapion*, ii., 21.—*Mesue*, De Ægrit. Pect., 7.—*Avicenna*, Canon, l. iii., 10, 4.—*Haly Abbas*, Theor., ix., 21; Pract., vi., 13.—*Rhases*, Divis., 54.—*Paulus Ægineta*, l. iii., ch. 33. (Transl. by *F. Adams*, for Sydenham Society, p. 496.)—*F. Bonafides*, De Cura Pleuritidis per Venæsectionem, 4to. Venet., 1533.—*A. Jurinus*, De Duratione Plenrit. per Venæsectionem, 4to. Basil., 1527. —*V. Benedictus*, De Pleuritide Liber, 4to. Venet., 1536.—*J. F. Arma*, De Pleuritide, 8vo. Ferrara, 1549.—*P. Brasso*, Apologia de Incisione Venæ in Pleuritide, 8vo. Paris, 1558. —*Trincavelli*, De Vena secanda in Pleuritide, 8vo. Pat., 1563.—*V. Halleri*, Bibl. Med. Pr., t. ii., p. 46.—*Vesalius*, in ibid., t. ii., p. 32.—*W. Bulleyn*, Regimen against the Pleurisy, 8vo. Lond., 1562.—*F. Cassanus*, De Venæ Sectione in Pleurit., 12mo. Patav., 1564.—*J. Wyer*, Observationum rararum Liber, de Scorb. Pestilenti, Angina, Pleuritide, Peripneumonia, &c., 4to. Basil., 1567.—*F. Cigalini*, Epist. de Oxymellis Usu in Pleurit., 8vo. Tigur., 1592.—*R. Moreau*, De Missione Sanguinis in Pleuritide, 8vo. Paris, 1622; et De Loco affecto in Pleuritide, 8vo. Paris, 1641.—*M. Ruland*, Utrum in omni Pleur. Vena dextri Cubiti secanda? 8vo. Basil., 1627.—*Amatus Lusitanus*, Cur., cent. i., Nos. 12, 53, 59.—*N. Wright*, Theses Medicæ de Pleur. Vera, 4to, 1635.—*Ballonius*, Opera, t. i., p. 24; t. iv., p. 313.—*V. Martinii*, Opuscula de Vesicantibus, de Orthopnœa Pleuritidis, &c., 4to, 1636.—*Zacutus Lusitanus*, Med. Pr. Hist., l. ii.; et Prax. Admir., l. i., obs. 104.—*V. Baronius*, De Pleuropneumonia Flaminiam Populantur infestante, 4to. Forol., 1635.—*G. Ballonius*, Liber de Rheumatismo et Pleuritide Dorsali, 4to. Paris, 1642.—*Riverius*, Observ., cent. ii., No. 63.—*B. Baldi*, De Loco affecto in Pleuritide, 8vo. Romæ, 1643.—*A. Cleti*, Circa Partem affectam Pleuritidis, 8vo. Rom., 1643.—*Diemerbroeck*, Anat., l. ii., c. 13, p. 309; et Disp. de Morb. Thoracis, No. 1.—*Bartholinus*, De Usu Nivis Medico, ch. 26.—*Prosper Alpinus*, De Med. Ægypt., l. iii., cap. 4.—*A. Banda*, Discours contre l'Abus des Saignées, qui prouve que la Saignée n'est pas l'unique ni le plus assuré remède des Pleurésies, 8vo. Sedan, 1672.—*Sydenham*, Opera Edit. Societ. Sydenhami, 8vo, p. 244.—*Willis*, Pharmac. Ration., p. ii., sect. i., c. 8.—*J. S. Knisel*, Historia Pleuritidis et Abscessus Pectoris, 4to. Tubing., 1690.—*C. Von Campen*, Collectanea Therapeutica de Pleuritide et Apoplexia, 8vo. Breda, 1692.—*F. H. a Fonseca*, Pleurologia, de Pleuritide ejusque Curatione, 4to. Lisb., 1701.—*A. Pascoli*, Observat. de Pleuritide, 4to. Venet., 1702.—*Bonet*, Sepulchretum, l. iv., s. i., observ. 3, 20, 45. —*F. Hoffmann*, De Pleuritide et Peripneumonia, Opera Suppl., t. i., p. 165.—*Baglivi*, Prax., l. i., Oper., p. 35.—*J. B. Verna*, Princeps Morbor. Acutor. Pleuritis, 4to. Venet., 1713.—*A. Camerarius*, et *J. G. Seeger*, De Pleuritide Maligna; in *Halleri*, Disp. ad Med., &c., vol. ii.—*Friend*, Comment. de Feb., No. v.—*Giffard*, in Philosoph. Trans., No. 395.—*J. Tennent*, Epistle to Dr. Mead, concerning the Epidemical Diseases of Virginia, particularly Pleurisy and Peripneumony, &c., 12mo. Edin., 1742.—*Dover*, Legacy, &c., p. 144.—*Huxham*, Opera, t. ii., p. 168.—*J. N. Bouillet*, Memoire sur les Pleuropneumonies Epidemiques, 4to, 1759. —*Morgagni*, De Sed. et Caus. Morb., Ep. xx. et xxi.—*Wright*, in Med. Facts and Observations, vol. vii., art. i.—*G. V. Zeviani*, Della Rachitide, et della Pleuritide, 4to. Verona, 1761.—*M. Flemyng*, On Adhesions of the Lungs to the Pleura, 8vo. Lond., 1762.—*Chalmers*, On the Weather and Dis. of South Carolina, vol. ii., p. 106.—*Bertin*, An in Pleuritide Sanguis mittendus e Brachio Lateris affecti, 8vo Paris, 1763.—*D. W. Triller*, De Pleur. Æstiva; in Opuscul., vol. i., 4to. Lips., 1766.—*Cleghorn*, On the Diseases of Minorca, &c., p. 238.—*Mursinna*, Von Faulfiebern, p. 154.—*B. L. Tralles*, Commentatio de Usu Vesicantium in Pleuritide, 8vo. Bresl., 1776.—*S. Musgrave*, Gulstonian Lectures, &c., on the Pleurisy and Peripneumonia, 8vo. Lond., 1779.—*Ranoé*, in Act. Reg. Soc. Med. Hann., t. iii., p. 246, et t. iv., p. 216.—*Bang*, in ibid., t. i., p. 10.—*Callisen*, in ibid., t. i., p. 60.—*De Haen*, Rat. Med. Pr., t. xi., ch. 2.—*Hamilton*, in Edin. Med. Comment., &c., vol. ix., p. 7.—*Thomann*, Annales Wirceb., t. i., p. 9.—*C. Strack*, Nova Theoria Pleuritidis, &c., 8vo. Mogunt., 1786.—*Vitriarius*, De Signis Diagnosticis et Prognosticis Pleuritidis, &c., 4to. Giess., 1786.—*M. Stoll*, Rat. Med. Pr., t. ii., p. 362; t. iii., p. 54, 115; t. vii., p. 182.—*Sims*, Observations, &c., p. 45. —*Millar*, Observations on the Prevailing Diseases of Great Britain, p. 20.—*F. Fiorani*, Saggio sulla Pleur. Biliosa Epidemica, 8vo. Firenz., 1792.—*G. J. Maschke*, Historia Litis de Loco Venæsectionis in Pleur., 4to. Hal., 1792.—*Portal*, in Mém. de l'Acad. des Sciences à Paris, 1789; et Sur le Traitement de plusieurs Malad., &c., t. ii., p. 54.—*Gehel*, in Hufeland's N. Journ. der Pract. Arzneyk., t. i., p. 180.—*Conradi*, in ibid., t. iii., p. 763.—*C. Racine*, Recherches sur la Pleurésie et la Péripneumonie latente Chronique, 8vo. Paris, 1803.—*Pinel et Bricheteau*, in Dict. des Sciences Méd., t. xliii., p. 185.—*G. Andral*, Clinique Médicale, t. iii., 8vo. Paris, 1826.—*Chomel*, Dict. de Méd., t. xvii.—*Law*, Cyclop. of Pract. Med., vol. iii., p 357.—*Andral*, Archives Générales de Méd., t. iii., p. 246. (*On Inflammation of the Diaphragmatic Pleura.*)—*Bonnet*, in ibid., t. xxi., p. 86.—*Schmidtmunn*, Observat. Med., t. i., p. 104.—*E. Gintrac*, Le Diagnostic des Affections Aigües et Chroniques des Organes Thorachiques, 8vo. Lond., 1826. —*T. H. Laennec*, Treat. on Dis. of the Chest, &c.; transl. by *J. Forbes*, 3d ed., 8vo. Lond., 1829, p. 426.—*J. Houston*, Descrip. Catal. of Prepar. in the Mus. of Coll. of Surg. in Ireland, vol. ii., Pathology, p. 171.—*M. Histz*, Recherches Cliniques sur quelques Points du Diagnostic de la Pleurésie; dans Archives Génér. de Médecine, 2d ser., t. xiii., p. 172, 1836.—*Heufelder*, Sur la Pleur. Chron. et l'Empyema: in ibid., 3d ser., t. v., p. 59, 1839.—*Cruveilhier*, Dict. de Med. et Chirurg. Prat., t. iii., 8vo. Paris, 1835.—*W. Stokes*, A Treatise on the Diagnosis and Treatment of Diseases of the Chest, 8vo. Dubl., 1837, p. 459; Lancet, No. 619, p. 466. —*C. J. B. Williams*, The Pathology and Diagnosis of Diseases of the Chest, &c., 4th ed., 8vo. Lond., 1840, p. 103, and Library of Medicine, vol. iii., p. 108; Med. Gazette, March, and Apr. 28, 1838, p. 2, 161.—*Watson*, in Med. Gazette, Jan. 27, 1838, p. 696.—*Wilson*, in ibid., June 10, 1837, p. 395.—*Porral*, Journ. Hebdom. de Méd., t. iii., p. 215. (*Hæmorrhagic Pleuritis, and Hæmorrhage into Pericardium.*)—*Graves*, Clinical Medicine, &c., p. 792.—*Greene*, Dublin Journal of the Medical Sciences, vol. xvii., p. 275. —*R. L. Mac Donnell*, On Empyema; in ibid., vol. xxv., p. 1. (*An excellent Memoir.*)—*P. C. A. Louis*, Researches on Phthisis, Anatomical, Pathological, and Therapeutical, 2d edit.; transl. by *W. H. Walshe* for the Sydenham Society, 8vo. London, 1844, p. 276.—*C. E. Hasse*, An Anatomical Description of the Diseases of the Organs of Circulation and Respiration; transl. by *W. E. Swaine* for the Sydenham Society, 8vo. Lond., 1846, p. 181.—*C. Rokitanski*, Handbuch der Pathologischen Anatomie, 8vo. Wien., 1842, b. iii., p. 43.—*G. Williamson*, Catal. of Prepar. in Museum of Army Med. Dep. Fort Pitt, &c., 8vo. Lond., 1845, p. 96.—*J. Paget*, Descrip. Catal. of Anat. Museum of St. Bartholomew's Hospital, 8vo. Lond., 1846, p. 282.

[For *Am. Bib.*, see various works on the Theory and Practice of Med. and Pathology, referred to under Pneumonia, Phthisis, &c.; also various Am. Med. Journals, *passim*.]

PLEURODYNIA.—Synon. *Pleuralgia, Pleurodynia* (from πλευρά, the side, and ὀδύνη, pain)

Pleuritis spuria, pseudo-pleuritis. Neuralgia thoracica, Pleurodyne, Auct. Var. *Dolor lateris. Rheumatismus Pectoris,* Naumann. *Pleurodynie, Point de Côte, Fausse Pleurésie,* Fr. *Der Seitenschmerz, der falsche Seitenstich,* Ger.

Classif.—I. Class, IV. Order (*Author*).

1. Defin.—*Pain in the side, usually occurring and ceasing suddenly, independently of any physical sign of inflammation of the pleura, and generally connected with rheumatic, neuralgic, or hysterical affection.*

2. *Pleurodynia* and pleuralgia are names in no way applicable to the painful affection under consideration, inasmuch as there is no evidence in favour of the pleura being at all implicated in it, unless it change its nature, or superinduce or pass into pleurisy. If, however, the word πλευρα be viewed, as it was by the ancients, as meaning the side, without reference to any particular part or structure of the side, these terms will appear much less objectionable. That this affection is not always rheumatism of the chest, as implied in the name given to it by Naumann, is a fact which experience will soon teach the inexperienced. Nor should it be viewed, as it has been by M. Jolly and others, as inflammation of one or more of the muscles of the thorax. But it is often connected with rheumatism, either in some other part of the body, or with the rheumatic diathesis; and it may be converted or pass into inflammation of the pleura, or of the pericardium, owing either to the predisposition and constitution of the patient, or to injudicious treatment. When it thus presents a rheumatic character, then it is to be viewed and treated as I have advised in the article Rheumatism, although it is by no means demonstrated, however frequently it has been assumed, that the pain constituting the principal feature of the disorder is caused by an affection of the intercostal muscles, or of the fibrous fascia lining the chest.

3. I. Causes.—Persons of a nervous, susceptible, or irritable temperament; of the rheumatic and hysterical diathesis; those who are exposed to atmospheric vicissitudes, to currents of cold air, to marshy or humid exhalations, or to cold or wet in any way, and those who live in damp, cold, and low houses, or in cellars, &c., are the most liable to experience those rheumatic and neuralgic affections in the side which have generally received the name of pleurodynia. Owing to the greater exposure of males than females to these causes, the former are most liable to them; and adults and aged persons are more frequently affected than children and young persons. But all the causes of inordinate excitement, and of exhaustion or direct depression of the nervous system, both predispose to, and more immediately occasion, painful affections, in either side, as well as in other parts of the body. Owing to the prevalence of the above causes, especially those which proceed from season, climate, and the soil and water of a locality, pleuralgic affections may be so prevalent as to be *endemic*, but they can rarely be considered as epidemic, or as being so generally prevalent, even in those localities, as to deserve that character.

4. II. Description.—Pleurodynia varies much in character with the causes which produce it, and according as it occurs in a *rheumatic, neuralgic,* or *hysterical* diathesis, or presents either of these forms.—(*a*) In the first of these forms, it may be either acute or chronic; in the former it is sudden, severe, lancinating, increased upon pressure, even upon the slightest pressure or contraction of the affected muscles. It often ceases as suddenly as it appeared, the pain shifting, or having shifted, to some other part. This more acute state of the affection is frequently attended by more or less fever, and the other phenomena of acute rheumatism. The chronic state is generally prolonged for many days, sometimes subsiding altogether for a time, and then suddenly recurring either in the same place, or in the vicinity. It occasionally ceases during the day, and recurs at night; or it disappears when warm in bed, to return at some period of the day. The pain is exacerbated during respiration; but this may take place either during inspiration or expiration only or chiefly, according as the muscles and nerves supplying be inspiratory or expiratory. Coughing, sneezing, and all movements which affect the muscles, occasion a sharp or cutting pain of the part.

5. (*b*) The *hysterical* and *neuralgic forms of pleurodynia* are more manifestly seated in the sentient nerves than the rheumatic, and are referred chiefly to some part between the sternum and spine. They are often connected with irritation about the origin of the dorsal nerves, or in the ganglionated roots of these nerves; this irritation, whether functional or inflammatory, being either seated there, or reflected thence from the renal or sexual ganglia, or nerves, or from the uterus and ovaria. These forms of pleurodynia are much more frequent in adult females than in males; in the nervous and irritable temperament; in persons who are subjects of anæmia, or who are liable to irregular determinations or distributions of blood; and in those especially about the period of the catamenia, and when this discharge is irregular, difficult, scanty, or interrupted. (See *art.* Hysteria, § 78, *et seq.*, and Neuralgia, § 89, *et seq.*)

6. (*c*) Occasionally cases occur in which the pain cannot be referred either to rheumatism or to any neuralgic or hysterical condition, but rather to *disorder* of some one of the *digestive viscera;* to either the stomach, the duodenum, the colon, or the liver. In these cases *flatulence* is a very prominent symptom, the pleurodynia being entirely sympathetic of the distention or irritation caused by the flatus contained in one or more of these viscera. But, in addition to this symptom, other indications of disorder of the digestive organs are usually present, especially a loaded tongue, the edges being red or flabby; an irregular and flatulent state of the bowels; and an unhealthy condition of the secretions and excretions. These symptoms are, however, often present in the other forms of pleurodynia, but they exist in this generally in a very prominent manner, and without any evidence of rheumatism, or of hysteria having been previously complained of.

7. III. The Diagnosis of pleurodynia rests upon, 1st, the phenomena immediately connected with the painful affection; and, 2d, the absence of the symptoms and physical signs of pleuritic, pericardiac, and pulmonary disease. If pleurodynia occur in connexion with rheumatism or in the rheumatic diathesis, or if the patient be subject to any form of hysterical af-

fection, or furnisn any indication of spinal irritation, or be liable to disorder of the catamenial discharge, then it may be suspected that the pain is independent of inflammation of the pleura or lungs; but the suspicion can be confirmed only by a careful examination of the chest by percussion and auscultation, and by the absence of the physical signs attending inflammatory or structural diseases of the thoracic viscera. The negative evidence thus furnished, the absence of many of the rational symptoms of these diseases, the manifest nervous, or rheumatic, or dyspeptic character of the affection, and the several causes or circumstances which appear to have produced it, will generally guide the careful observer to a correct conclusion as to its nature and morbid relations.

8. IV. The Treatment should depend upon the conclusion thus arrived at. If the affection be manifestly rheumatic, the treatment advised for Rheumatism is required; and if the patient be young, robust, plethoric, &c., a moderate bleeding from the arm, or the application of leeches to the side, may precede other remedies. When the pain seems to depend upon disorder of the digestive organs, or upon biliary or other colluvies, then a suitable but smart emetic, followed, after an interval, by cholagogue aperients, hy a warm bath, and by diaphoretics, will generally remove it. As this affection is merely the manifestation of a disorder seated more internally or deeply, the suppression of it by external applications should be avoided until the primary affection is removed hy a treatment directed to it entirely or chiefly; and when all disordered secretions and excretions are removed, and when the functions and tone of the digestive organs are restored, then whatever of painful affection may remain may be treated by rubefacient and anodyne embrocations or applications, by tonics, and the other means advised for Neuralgia. The treatment should in every respect be directed conformably with the morbid relations which the case may present. The very general connexion existing, in females, between this affection and disorder of the catamenia requires that treatment should be more especially directed to the removal of that disorder. In this form of the affection, as well as in every other, the intentions and means of cure should have for their objects the precise origin of this and of its associated evils, and the removal of the source of them just adverted to; for as long as it exists the symptomatic effects will recur again and again, or whenever circumstances favour their evolution.

Bibliog. and Refer.—*D. G. A. Richter*, Die Specielle Therapie, b. i., p. 407.—*Chamberet*, in Dict. des Sciences Médicales, vol. xliii., p. 217.—*J. Jolly*, in Dict. de Méd. et Chirurg. Prat., art. *Pleurodynie.*—*Williams*, in Lib. of Pract. Med., vol. iii., p. 134.

PNEUMATHORAX.—Synon. *Pneumothorax*, Itard. *Pneumathorax* (from Πνεῦμα, air, and θώραξ, the chest). *Pneumatothorax.; die Luftbrust*, Germ. *Pneumothorax*, Fr.

Classif.—IV. Class, II. Order (*see Preface*).

1. Defin.—*The presence of air in the pleural cavity, occasioning collapse or compression of the lung, extreme dyspnœa and anxiety, and obvious physical phenomena.*

2. I. Pathology of.—Pneumathorax is the consequence of lesions, generally of both the lungs and the pleura, or rather of the lung implicating the pleura, allowing the irruption of air into the pleural cavity, and thereby suddenly occasioning severe circumscribed pain in one side, great anxiety, and extreme dyspnœa. It may occur at any period of the course of phthisis; and, as in one case in my practice, it may even take place before the patient has complained, or had recourse to medical aid. This dangerous and generally fatal result of pulmonary tubercles has attracted attention only in modern times. It is usually developed as follows:

3. (*a*) A tubercular cavity may extend to the pleura, inflame, and ultimately perforate this membrane, before adhesions have formed between the opposite surfaces, and thus the air will pass into the cavity of the pleura. This is the most common way in which pneumathorax occurs.—(*b*) One or more tubercles may form so close to the pleura as to perforate this membrane, and open into a minute bronchus, in the course of softening, even at an early period of the pulmonary disease, and without having produced a limited inflammation of the pleura, or adhesion of the opposite surfaces, at least in a sufficient degree to prevent the passage of air into the cavity of the pleura. This, however, does not occur so frequently as the former; yet I have met with two cases.—(*c*) In the course of partial pleurisy, the absorption of the contained fluid may leave a void, which is not occupied either by a contraction of the parietes of the chest or by the lung, which continues either condensed, or bound down by adhesions or false membranes. This vacuum, which may be either very small or more considerable, contains air secreted by the surfaces, by which the fluid was absorbed. Dr. Williams mentions two cases of this kind; but this is a rare form of pneumathorax.—(*d*) It has been supposed that the products of pleurisy may undergo such changes as will develop a gaseous fluid, especially in the more cachectic states of the disease, and at an advanced period, or shortly before death. Without denying the possibility of this occurrence before death, it may be admitted to take place, in some instances, soon after death. There is not, however, sufficient evidence of this change in the effused fluids in pleurisy having supervened during life to allow of its being ranked as a variety of pneumathorax.—(*e*) Air may also be present in the cavity of the pleura, owing to a fistulous opening through the parietes of the chest, or in consequence of a fistulous communication between this cavity and the bronchi on the one hand, and the external surface on the other.

4. The intimate adhesions which usually form between the pleura covering the tuberculated portion of lung and the costal pleura obviate the occurrence of pneumathorax; yet when these adhesions either do not take place, or when they are either incomplete or not intimate, and the softened tubercles or the extending ulceration perforates the pleura, then the air passes into the cavity, distends it, compresses the lung, and gives rise to the symptoms and physical signs of this organic mischief. Most frequently the resulting perforations are small, consisting of an oval aperture, or small fissure, three or four lines long, frequently in

the midst of a soft, dirty, grayish, or yellowish texture, which is easily torn. There is usually only one perforation; but several in the same case have sometimes been met with. The perforation occurs in about five sixths of the cases near the angles of the third or fourth ribs; that is, in a place corresponding with that where pain was felt, and where pleuritic adhesions, when not general, commonly terminate. In other cases it is more or less distant from the apex of the lung; but it very rarely takes place at the apex, owing to the frequency of adhesions in this situation.

5. Perforation of the pleura, occasioning pneumathorax, is much more frequent on the left than on the right side. This is probably owing to the somewhat more frequent occurrence, and the more advanced progress, of tubercular ulceration in the left than in the right lung. Dr. Reynaud found, in forty cases of perforation, ascertained by post-mortem examination, that this lesion was twenty-seven times on the left side, and thirteen times on the right; and in ten similar cases, not demonstrated by examination after death, the left side was affected in six cases, and the right in four. Dr. Hasse met with pneumathorax nine times on the left and seven times on the right side. M. Louis observed this lesion seven times on the left side, out of the first eight cases which occurred to him.

6. The perforation generally depends upon the progress of ulceration, usually tubercular, very rarely gangrenous, through the pleura. In ordinary circumstances, when ulceration approaches the pleura, inflammation, with the exudation of plastic lymph, supervenes at that part of this membrane which is nearest the ulcerated cavity, and protects that part of it, either by covering it with a thick false membrane, or by uniting it to the opposite surface by this medium. If a firm adhesion of the surfaces has formed, and the ulceration proceeds, perforation of both the pleura and the false membrane takes place without being followed by pneumathorax; and even the parietes of the chest may ultimately be perforated, the adhesions of the pleural surfaces around the fistulous perforation preventing the air from passing into the cavity of the pleura. But in other cases, especially when either vital power and resistance are weak, or the lymph thrown out is of an unhealthy or unorganizable character, and hence neither false membranes nor intimate adhesions are formed, or are not formed in a state sufficient to protect the ulcerated surface, the air passes into the cavity of the pleura, at one or more points, upon sudden efforts, or severe fits of cough. Ulceration may advance until the pleura is nearly perforated, either without the production of a false membrane or of adhesion, or with these in a more or less incomplete state, when a severe fit of coughing, or a forced inspiration, or some effort, or even an external injury, causes the thinned or ulcerated point to give way suddenly, and induces all the symptoms and signs of pneumathorax.

7. II. Symptoms and Signs.—*A.* Symptoms.—The effects of the perforation are *immediate* and *consecutive*.—(*a*) The *immediate effect* is to admit air more or less rapidly into the cavity of the pleura, which permits the lung to assume that state of collapse to which its natural contractile property would reduce it, by equalizing the atmospheric pressure within and without it. In addition to the introduction of air and the dyspnœa thus rapidly produced, the sensibility of the part is generally also suddenly and severely excited, and, with the extreme dyspnœa and pain, great anxiety is felt. The connexion between the lesions and the symptoms is remarkably striking. The pain corresponds with the rupture of the thinned portion of pleura and the irruption of the tuberculous matter into the pleura, and is caused by these occurrences; while the threatened suffocation and anxiety are the effects of the rapid passage of air and of some fluid matter into the pleural cavity. Therefore, when acute pain, oppressed breathing, extreme anxiety, and the symptoms of acute pleurisy display themselves *suddenly* in one side of the chest of a tubercular or phthisical patient, we may suspect the occurrence of perforation of the pleura, and ascertain the presence of pneumathorax by examining the chest.

8. (*b*) The *consecutive effects* of perforation vary in different cases. Although perforation of the pleura will not fail to allow air to pass into the cavity, yet the size and other conditions of the opening modify the amount of air introduced and the effects which follow. If the perforation be very small, or if it be so placed that the walls of the chest close it upon expiration, or if it be below the level of the effused fluid, or if the opening be of such a form as to become valvular, and to close the aperture on expiration, air will pass into the cavity in accumulating quantity, and occasion an increased compression of the lung; and even suffocation in the course of a few hours, and before many of the consequences observed, in cases of longer duration, can take place. When, however, the termination of the mischief is not so rapid, the presence of air in a cavity neither accustomed to, nor organized for it, and of the matters which pass along with the air from the ulcerated cavity, excite with more or less rapidity great irritation and inflammation of the pleura, attended by acute pain, dry cough, dyspnœa, spasms of the intercostal muscles; quick, weak, or irregular pulse; heat of skin, and all the symptoms of acute pleurisy, with the physical signs of pneumathorax (§ 11), and of liquid effusion accompanying the air contained in the pleural sac.

9. When the aperture, by which air passes into the cavity of the pleura, is large, there is a frequent renewal of the air in this cavity; for the lung is kept in a state merely of collapse, and not of forcible compression; the air passing out of the cavity, as well as passing in, to a partial amount. The consequences are, a more copious purulent secretion takes place from the pleural surface, and this secretion always becomes more or less fetid if it continue for some time. The foregoing symptoms, however, are not of themselves sufficient to show the existence of pneumathorax; for, notwithstanding the sudden supervention of acute pain in the side, with oppressive dyspnœa and anxiety, and although, in some instances, these symptoms may be instantly felt after a fit of coughing, or upon exertion when the patient has felt as if something had given way in the

pained place, still all these phenomena may exist in some acute cases of pleurisy, without any perforation; while, on the other hand, perforation and pneumathorax may take place without any very acute or suddenly developed symptoms, although this is seldom observed. The physical signs, therefore, are chiefly to be depended upon for the diagnosis of this lesion.

10. When the quantity of air which is passed into the pleural cavity is great, if there be no adhesions between the opposite surfaces of the pleura, or if these adhesions be inconsiderable or admit of being much stretched, the lung is compressed and forced against or towards the spinal column. At the same time, the thoracic parietes on the affected side are distended, the ribs separated, the diaphragm depressed, and the mediastinum pushed to the opposite side. The widening of the intercostal spaces, the rounding and dilatation of the parietes, the much less degree of motion during respiration, and the much greater dimensions of the affected side upon admeasurement, sufficiently indicate the distention of the pleural cavity by the accumulation of a fluid; the nature of the fluid, whether gaseous or liquid, being readily indicated by the physical signs. The viscera are also displaced by the contained air. The heart and mediastinum are pushed to the right side, if the left be the seat of lesion; and towards the left axilla, if the right is so affected, and if the air be in great quantity, while the liver and stomach are pushed downward; the upper regions of the abdomen sometimes protruding more or less.

11. *B.* The Physical Signs are the most important of the *consecutive effects* of pneumathorax, and are generally very distinctive. The air contained in the pleural cavity gives the walls of the chest a greater degree of resonance on percussion than when the structure of the lung is naturally distended with air. According as the quantity of air is great, so is the sound produced by percussion the more hollow or drum-like, owing to the farther removal of the collapsed or compressed lung from the parietes of the chest, and to the diminished entrance of air into the lung. Hence pneumathorax may instantly be detected by a remarkable contrast of physical signs, namely, by a very hollow or clear sound on percussion of the affected side, with little or no vesicular sound of respiration, while the healthy side gives a duller sound on percussion, but a much more distinct respiratory murmur.

12. Perforation of the pleura, and its consequences, pneumathorax, and the effusion of fluid, give rise to other phenomena which are farther *diagnostic* of these lesions. These are the *sounds* which have been termed the *metallic tinkling sound*, the *amphoric sound*, and the *sound of fluctuation*.

13. (*a*) *Metallic tinkling* has been variously accounted for by several writers, but none of the explanations, and some of them have been sufficiently singular, and others equally laborious, appear satisfactory. This sound is heard most distinctly when the pleura is perforated, when much air is enclosed in the pleural cavity, and when there is also some fluid effused. It seems to proceed from the air passing, during inspiration, through the pleural orifice of the perforation, which, being partially obstructed by fluid or mucus, occasions a noise similar to that produced by the breaking of a bubble of air contained by an albuminous or other fluid, and the vibrations, being propagated through the enclosed air, give rise to the *clink*, or *metallic sound* or *tinkling* in question. According to this explanation, although perforation of the pleura most commonly causes this sound, it may, nevertheless, be heard in other circumstances in which air is contained in the pleural cavity, provided that, during respiration, the air in struggling through a fluid forms bubbles, which, breaking on the surface of the fluid, causes a vibration which is propagated throughout the included air. From this it will follow, that whatever occasions such a degree of motion of the parietes of the chest, even *percussion* during the physical examination of this cavity, may occasionally develop this sound, which has so long puzzled many stethoscopists, which has mystified others, and which has concerned some but little who have paraded the stethoscope as a most serviceable instrument of charlatanry and humbug.

14. (*b*) The *tinkling sound* may thus present several modifications. Where the perforation is protected or obstructed by its position against the walls of the chest or below the level of the fluid, the tinkling may not be heard unless upon coughing or taking a full inspiration, so as to cause bubbles to be formed in the affused fluid. But the smallness of the perforation, provided that air passes through, will not prevent or obscure the sound, as Dr. Williams has supposed. "When the orifice is large and free, the air will pass in and out in ordinary breathing, and will produce in its vicinity a sound like that of blowing into the mouth of a glass bottle," or the bung-hole of a small cask, and hence this sound has been called *amphoric*. In these cases the diseased lung is merely collapsed, not compressed by the accumulation of air in the cavity as when the perforation is small, and as it is described above (§ 8–10).

15. The tinkling or metallic sound may be heard only in certain parts of the chest; only where the lung is non-adherent, and where the effused liquid does not reach; only where a cavity is distended by air so as to give the parietes of the cavity a certain degree of tension, and to furnish the condition upon which the sound chiefly depends. In the sitting posture, this sound is heard best about the mamma, and lower part of the axilla and scapula; but in those cases in which the accumulation of air and the distention of the parietes are the greatest, it may be heard in every part of the affected side; while in others, where the collection of air is small, it may be heard only at one spot.

16. When there is a liquid effused into the pleural cavity as well as air contained in it, the diagnosis is generally easy. Percussion shows the level to which the liquid rises, according as it varies with the position of the patient. The motions of the liquid, also, especially upon coughing, will also often give evidence of the presence of air in the cavity. Dr. Williams has stated that, "on change of posture and on coughing, the liquid will sometimes drop from the parts which have just been immersed; and the sound of this will exhibit the metallic ringing in so distinct a manner, that it resembles

the note which a glass or porcelain vessel yields when struck." (P. 132.) I think that Dr. Williams is mistaken in this; for, however change of position may produce this sound, whether as I have explained it or otherwise, I am certain that no dropping takes place, or can possibly take place, in the physical circumstances of the parts; but that, in all changes of position which can possibly be made, however extreme or opposite, the fluid will merely run down the parietes of the cavity, without dropping in any part.

17. (*c*) If the patient be shaken forcibly, or if he give the trunk a jerk, or an abrupt turn or shake, the sound, which was first mentioned by Hippocrates as resembling the *splashing* of water, will be distinctly heard. This sign has been aptly termed *Hippocratic fluctuation*, and is heard when the ear is applied to the side at the time of *succussion*; the tinkling sound being also heard to accompany or to follow it, as the air bubbles break on the surface of the fluid or at the pleural orifice of the perforation. Fluctuation or splashing is best heard when there is much air in the cavity and a moderate or considerable quantity of liquid. Percussion will frequently indicate the proportions, if carefully performed.

18. III. The Prognosis of pneumathorax is very unfavourable, not so much as regards the presence of the air in the pleural cavity as the lesions of which it is the consequence. Pneumathorax most frequently, especially when supervening at an advanced stage of tubercular consumption, rapidly hastens a fatal termination; but in more favourable circumstances, or earlier stages of that malady, life may be prolonged for some indefinite time after its occurrence; rarely, however, for a longer period than a few months. Dr. Houghton has recorded a case of a bricklayer who lived eighteen months after perforation had taken place, and who might have lived longer if he had not imprudently exposed himself in his business, for the signs of a cavity had disappeared, the side had contracted, and his general health had much improved. Dr. Stokes has adduced the case of a gentleman who lived for many months, and who generally heard a splashing noise in his chest when on horseback. Cambalusier and Laennec refer to cases which they consider to have recovered, but upon insufficient evidence. Dr. Williams states, that he has seen "two cases leave the hospital with the impression that they were nearly well, having gained flesh and lost the worst phthisical symptoms after the first severe consequences of the perforation had subsided." (P. 133.) My experience leads me to conclude, that, when the tuberculous disease is limited, when perforation occurs at an early stage of that disease, and when the constitutional powers of the patient are not much impaired—circumstances in which perforation rarely takes place—then life may be prolonged for a considerable period, if a cure even may not be effected. For it is not impossible for a superficial tubercle, or very small cavity, to perforate the pleura, and, by such perforation, or the rupture of the nearly perforated pleura, to allow the passage of air into the pleural cavity, the compression of the lung, and the exudation of lymph upon the surface of the perforated membrane, favouring the diminution or obliteration of the cavity, and the occlusion, or even the cicatrization of the aperture. In these circumstances, therefore, it is not unreasonable to hope for a considerable prolongation of life, even although complete recovery may not take place. M. Laennec has adduced an instance in which the patient lived six years after pneumathorax appeared; and M. Chomel has considered perfect recovery not impossible, the parietes of the chest falling inward, as in recovery from certain cases of empyema (*see* Pleura, § 78).

19. IV. Treatment.—This should vary with the several circumstances under which perforation or rupture of the pleura and the passage of air into the pleural cavity take place, with the period which has elapsed since the occurrence, and with the existing state of the patient. When the perforation and passage of air into the cavity have just occurred, the patient often presents many of the indications of having received a vital shock; he is pale, anxious, faint, feeble, and depressed physically and morally. At the same time, he complains of oppressive dyspnœa and pain, and his pulse is rapid and feeble. In this state lowering measures would be dangerous. Gentle restoratives, with opiates, are chiefly indicated, as camphor or ammonia, with morphia; but reaction often occurs, if the accumulation of air and the suffocative dyspnœa (§ 8, *et seq.*) prevent not its supervention. Nevertheless, the irritation and inflammation of the pleura produced by the air are generally attended by some indication of reaction after some hours, although this may be imperfect, or but slightly developed. The pain which is complained of should not be considered as a proof either of the presence or the amount of inflammation, or even of irritation of the pleura, for it is often greatest immediately upon the perforation and passage of air into the pleura, and before inflammation is developed by the occurrence. Besides, it is often occasioned by the stretching of adhesions which had existed, and is thus, as well as in other circumstances, independent of inflammatory action. Still we should be prepared for the supervention of inflammatory irritation of the pleura soon after the air has acted upon this surface, especially if the atmosphere at the time be cold and dry; and this complication of inflammation with the pneumathorax will be more certainly indicated by the states of the pulse, skin, and tongue than by the amount of pain. If the pulse become hard or constricted, the skin dry, and warmer over the affected side, or if the parietes of the side are tender or sore upon pressure or percussion, and if the patient be young, robust, or plethoric, or of the sanguine temperament, then blood-letting, general or local, the latter most frequently, but the former in some instances, and both in others, especially in the circumstances just stated; antimonials, mercurials, and opiates; cooling diaphoretics, aperients, and external derivatives and counter-irritants, as advised for *inflammations of the pleura*, are the means chiefly to be relied on. But these means should be directed with due attention to the peculiarities of individual cases, as insisted upon in the preceding article.

20. Instantly upon the occurrence of this lesion—within even a few minutes of it, as I have seen in one instance—but at any indefinite period afterward, the quantity of air drawn into

the pleural cavity may be so great, and the distention of the parietes of the side so very considerable, as to suggest reasonable fears of almost immediate suffocation, not only from complete compression of the lung of the affected side, but also from a less compression of that of the other side. In these circumstances, exit should be given to the air by puncturing the parietes of the thorax. I am aware that the propriety of resorting to this mode of relief has been questioned; but an instantly impending fatal result has to be averted; and in some instances it may be averted for a considerable time, almost always for a short time, and possibly for months, or even years, by resorting to this operation. I believe that recourse to this operation should not be delayed when pneumathorax has occurred at an early period of phthisis, or when the patient is young, not greatly reduced, or while he has not advanced very nearly to a probable termination of a disease which would certainly end fatally, even if perforation of the pleura had not taken place. The pain and risk of the operation are nothing in comparison with the continued distress experienced during the pneumathorax; and although relief may be only temporary, the operation may be repeated several times without increasing the risk of life, but, on the contrary, greatly diminishing it.*

21. It is unnecessary to remark farther respecting the treatment of pneumathorax, inasmuch as the means which have been recommended for chronic pleurisy and empyema are generally applicable also for the more complicated malady which has just now been considered, due regard being had to the peculiar features of individual cases. (*See art.* Pleura, § 175, *et seq.*)

Bibliog. and Refer.—*B. M. Itard*, Dissert. sur le Pneumothorax ou les Congestions gazeuses qui se forment dans la Poitrine. Paris, 8vo, An. xi.—*R. T. Laennec*, Treatise on the Dis. of the Chest, &c.; transl. by *J. Forbes*, 8vo. London, 1829, p. 499.—*J. Forbes*, Original Cases, with Dissections and Observations illustrating the Use of the Stethoscope and Percussion in the Diagnosis of Dis. of the Chest, 8vo. Lond., 1824.—*Rayer*, Archives Gener. de Médecine, t. xvii., p. 345.—Various Cases illustrative of Pneumathorax. See t. v., p. 17 et 321; t. vi., p. 104; t. viii., p. 456.—*Littré*, in Journ. Hebdomad. de Médecine, &c., t. i., p. 49.—*Lenoir*, in ibid., t. i., p. 312.—*Lenormand*, in ibid., t. ii., p. 293. (*A Case in which Recovery appeared to have taken place.*)—*Duncan*, in Edin. Med. and Surg. Journ., vol. xxviii., p. 302. (*Chiefly Cases illustrating the association of Empyema and Pneumathorax.*)—*Gerard*, in Med. and Chirurg. Review, Oct., 1836, p. 562.—*W. Stokes*, Treatise on Dis. of the Chest, &c., 8vo. Dubl., 1837, p. 527; and Dublin Journ. of Med. Sciences, Sept., 1840.—*C. J. B. Williams*, On the Path. and Diag. of Dis of the Chest, p. 125; and Lib. of Pract. Med., vol. iii., p. 130.—*A. M. Saussier*, Recherches sur le Pneumothorax et les Maladies qui le produisent, les Perforations Pulmonaires en particulier, 8vo. Paris, 1841.—*Chomel*, in Dict. de Med., 2d edit., art. *Pneumothorax*.—*P. C. A. Louis*, Researches on Phthisis, &c.; transl. by *W. H. Walshe* for the Sydenham Society, p. 328. (*See*, also, Bibliog. and Refer. to art Pleura.)

* In 1833, a case of pneumathorax occurred in my practice, at an early stage of phthisis; the patient being young and robust, and not having lost flesh or strength. The nature of the mischief was prominently characterized: the heart was pushed remarkably far to the right side; and the rational and physical signs were all marked and extreme; the dyspnœa and distress were great. I advised that an opening should be made for the exit of the air; and the friends of the patient desired that Sir A. Cooper should make it. We met a few hours afterward; he admitted his ignorance of the nature of the lesion. I fully explained the cause of the symptoms, and of their extreme urgency; but he refused to perform the operation, stated that he had never performed it with the view of letting out air, and that he would not now do any thing so novel, although he would have been ready to undertake it when he was a much younger man. Having heard Sir Astley's determination, the patient's friends would not allow the operation to be resorted to by any one else; and the patient died, asphyxied, a few hours afterward. The operation, if it had been resorted to in this case, might have prolonged life for a very considerable period.

POISONS—Poisoning—Poisoned—Symptoms and Treatment of.

Classif.—General and Special Pathology and Therapeutics.

Poisons may be defined to be *substances which act injuriously upon the human body.* The number of substances which may be comprised under this definition, even in the present state of our knowledge of the productions of the three kingdoms of nature, is very great; and many of these, owing either to their weak powers, or to the imperfect state of our knowledge of their effects, will receive only a slight notice, or be entirely overlooked. It should, however, be recollected that there are many substances which act injuriously when improperly employed either as articles of food or as medical agents; this improper employment having reference rather to the quantity used, and the conditions of the frame in which it is employed, than to the injurious nature of the substance. The *definition*, therefore, may be extended as follows: *Substances which exert a deleterious influence on the human frame, when taken internally or applied externally, as regards either their nature or the quantity of them employed; or which tend, in either respect, to destroy life when thus used.*

1. While the word *poison* refers to the substance exerting the deleterious influence, *poisoning* is the commission of the injurious act, and *poisoned* is the state or effect resulting from the substance or agent employed. These words may thus be viewed as referring respectively to the *agent*, the *act*, and *actor*, and the *effects* or pathological states produced by the poisonous agent. It is obvious that the investigation of the *first* and *second* of these, with due precision, belongs to *legal medicine* or *medical jurisprudence*, and that it consequently does not fall within the scope of my work. I have only briefly to consider the *symptoms* and *effects of poisons*—the *pathological states* produced by substances, whose injurious effects have been observed and recorded by medical authorities, and the best *means of preventing, counteracting, or removing these states.* Before, however, I venture to discuss the pathological effects of individual poisons, and the treatment of these effects, I shall briefly consider, 1st. *The modes in which poisons are employed or exhibited.* 2d. *The action of poisons.* 3d. *The channels through which poisons act in producing their effects.* 4th. *The general effects of poisons;* and, 5th. *The special operation of poisons.**

* The following *Synopsis* will show the extent of consideration which a due discussion of the subject now before me ought to comprise. My limits, as well as the scope of the work, will admit only of a hasty view of the several topics here enumerated:

1. Modes in which Poisons are employed or exhibited.
   - i. *To the Respiratory organs*—Inhaled or Inspired.
   - ii. *Taken into the stomach.*
   - iii. *Applied externally*—(a) The cuticle not having been removed.
     - (b) To a surface the cuticle of which has been removed.
     - (c) Introduced by or into a wound.

2. I. The Modes in which Poisoning takes place, whether the act is felonious, intentional, or accidental—whether it is suicidal or from intentional exposure to the agent—are more diverse than may appear on a hasty view of the matter; and the effects produced and the treatment required are thus equally diversified: 1st. *Several gases, vapours, or fumes of volatile or vaporizable substances have been intentionally exhibited, or accidentally inhaled, so as either to arrest the respiratory actions, or to impede or obstruct, or otherwise influence the changes produced in the blood by respiration, as well as those changes of function, and sometimes even also of organization, which take place either primarily or consecutively in the nervous centres.* Several vapours or fumes, medicinal as well as poisonous, may be inhaled into the lungs with the view of producing certain anticipated effects. Some of these are thus employed more or less beneficially. Others are more obviously injurious, or even fatal; and a few have recently been directed to purposes which are considered beneficial, after the very superficial and empirical view which has hitherto been bestowed upon this mode of employing them. The vapours of several substances possess the power not only of impeding the changes produced in the blood by the air during respiration, but also of altering the physical characters of the blood itself and the state of the nervous functions. These alterations of the blood and nervous systems are produced not only immediately upon the blood circulating in the capillaries of the air cells, and upon the organic nerves supplying the respiratory organs, but also consecutively, owing to the passage of the vapour to some amount into the circulation, and to the actual admixture of it in the blood, and to its action on this fluid and on the nervous centres. The vapours of alcohol, of all strong spirituous liquors, of most ethereal fluids, of spirits of turpentine, and several volatile oils, produce a more rapid effect when inhaled in more or less concentrated states than when these substances are taken into the stomach; and if the vapour inhaled be much concentrated, or if the inhalation be continued for some time, the changes produced in the blood, and the effects on the nervous system, are such as to endanger or to destroy life. This more immediate and intense effect arises chiefly from the extent of surface upon which the vapour acts, and from the rapid imbibition of fumes or vapours by the respiratory mucous surface. But this subject will be more fully shown in the sequel, when the special operation of certain injurious agents is considered. Most of its pathological and therapeutical relations are discussed in the article Asphyxia.

3. 2d. The most frequent way in which poisons are exhibited is *that by the mouth, the injurious substance being taken into the stomach* either alone, or simply diluted, or in the drink or food. It is obvious that the symptoms and the effects of any poison are much modified by the state of dilution or of admixture with alimentary articles when thus exhibited, and by the condition of the stomach at the time, especially as regards the nature and amount of the contents of this viscus. The state of the constitution and of the health, and other circumstances connected with the person poisoned, as well as with the agent employed, also materially influence the effects produced in different cases by any individual poison, although the quantity exhibited is the same. The rejection by vomiting of a portion of the poison, the time that has elapsed from the moment of exhibition, the amount and character of the evacuations it may have produced, and the precise nature and character of the effects observed at the period when the patient has been first seen by the physician, require, both individually and in connexion, to be duly considered by him, the inferences which he must promptly draw from these being made the basis of the most prompt measures of aid. The digestive mucous surface being protected by a mucous secretion, and by the secretions furnished by the collatitious viscera, and frequently containing more or less partially-digested matters, in addition to the vehicle of the poisonous substance, an injurious effect is produced upon it much less readily in many instances, owing to these circumstances, as well as to the nature of the poison employed, than upon some other parts where the poison is more rapidly absorbed and carried into the circulation. Besides, the injurious substance is often in great part thrown off the stomach, or passed through the bowels; and that which remains, by irritating and inflaming the villous surface, is thereby prevented from being absorbed, or so entirely absorbed

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(d) Injected into blood-vessels.
iv. *Injected into the larger bowels.*
v. *Introduced or injected into the sexual organs.*
vi. *Injected into the urinary organs.*

II. The action of Poisons.
i. *Poisons act locally and primarily.*
ii. *Remotely and consecutively.*
iii. *Both locally and remotely.*
iv. *Chemically.*

III. Channels through which Poisons act.
i. *Primarily and locally.*
a. On the nerves of the part.
b. On the capillaries and vessels of the part, and the contained fluids.
c. On the irritability of the tissues.
d. On the general structure of the part.
ii. *Sympathetically, or by nervous influence;* or through the media of the organic and animal systems of nerves.
iii. *Organically, or by imbibition or endosmose, and absorption;* or through the medium of the circulating fluids.

IV. General Effects of Poisons.
i. *Depressing nervous influence and vascular action;* lowering vital power.
ii. *Inordinately exciting nervous influence, either organic or animal.*
iii. *Inordinately exciting vascular action.*
iv. *Exciting nervous influence and vascular action;* exciting vital power.
v. *Exhausting nervous influence;* or exhausting vital energy.
vi. *Altering nervous influence and vital power.*
vii. *Producing a succession of two or more of these states or effects.*

V. Special operation of Poisons.
i. *Abstracting the animal caloric or depressing the calorific process in a part, or throughout the body.*
ii. *Benumbing, depressing, or suppressing sensibility, or the organic nervous influence.*
iii. *Paralyzing involuntary motion and voluntary movements.*
iv. *Softening, liquefying, or dissolving one or more tissues or textures.*
v. *Irritating particular organs or parts.*
vi. *Astringing and increasing the tone or vital cohesion of certain tissues.*
vii. *Diminishing or increasing the irritability of contractile parts.*
viii. *Augmenting certain secretions and excretions.*
ix. *Stimulating the ganglial, spinal, or sensory nerves.*
x. *Altering the vital actions—the secretions and nutrition of particular organs or textures, according to the substance employed, and the mode of employment.*

as it might otherwise be, into the circulating fluids, absorption, imbibition, and endosmosis not so readily taking place in these circumstances as in others. Nevertheless, the injurious impression made by the substance taken into the stomach upon the nervous systems, and especially upon the organic or ganglial, may continue or may increase, and be extended to several of the collatitious viscera, and even to remote organs, as the brain, spinal cord, heart, lungs, and kidneys—to the former by nervous communication, and to the latter partly by this channel, and partly through that of the blood and vascular system, either mode of operation predominating in different cases, according to the poison which has been taken. I need not, however, dilate farther on this topic, as it will receive numerous illustrations in the sequel.

4. 3d. *When poisons are applied to the external surface of the body*, the effects are contingent upon the state of the cuticle, which forms an efficient protection against injurious substances, excepting such as are most irritating or virulent; and even many of these latter are inoperative, unless they are allowed to remain applied to the surface for a considerable time. —(*a*) The *protective power of the cuticle* varies in different temperaments and constitutions, substances which produce little or no effect when applied to the cutaneous surface of one person rapidly affecting others when thus employed. This difference most probably depends upon the varying grades of density, thickness, &c., of the cuticle, and possibly, also, upon the vascularity and sensibility of the subjacent tissues.

5. (*b*) Poisonous substances, applied to the skin *after the cuticle is removed*, or even to a mucous surface, but more particularly to this surface when its epithelium is detached, produce their effects with great rapidity, the period varying, however, with the situation, the duration of contact, and the nature and state of the substance. The effects depend upon the nature and intensity of the impression made upon the tissue, upon the sensibility and vascularity of the part, upon the rapidity and amount of imbibition and absorption, and upon several other circumstances, which will be more fully set forth hereafter.

6. (*c*) *When a poison is inserted in a wound*, the effects will be nearly co-ordinate with those which result from its application to a surface deprived of its cuticle or epithelium, some variation, probably, resulting from the nature and situation of the wound, and upon the degree in which the injury may favour the retention, and the situation facilitate the absorption of the poison.

7. (*d*) *The passage of the poison into a vein*, or the *injection of it into a vessel*, is productive of the most rapid effects, relatively to the operation of the particular agent employed; for not only is a local effect thereby produced, but the poison, being directly carried into the circulation, operates, according to its nature, both upon the blood and vascular system, and upon the nervous centres, and the vital and excreting organs.

7*. (*e*) When a poisonous substance is employed externally in either of the modes now indicated, the effects depend principally upon its nature. Numerous specific or other animal poisons, and several virulent vegetable poisons, are thus inoculated; and diffusive or septic inflammation and destruction of the cellular tissue, erysipelas, the contagious exanthemata and fevers, inflammations of the lymphatics, veins, arteries, and glands, various specific diseases, as rabies, smallpox, &c., and other virulent maladies, in which the organic nervous energy is depressed or annihilated, and the circulating fluids are contaminated, are thereby produced. The inoculation of most of these poisons is accidental, but it may be intentional —felonious or suicidal. Certain of these poisons, when allowed to remain in contact with the surface, may produce their usual effects, although the cuticle or epithelium is entire; but when they are brought in contact with an abraded surface, or introduced into a punctured or incised wound, the effects are rapid, and vary in character with the nature of the poison, and the affection of the constituent tissues of the part injured, some occasioning a septic contamination—a solution and disorganization of the cellular tissue, which rapidly spreads, and poisons the circulating fluids; others affecting the veins, and producing asthenic and spreading inflammation of them, with all its worst consequences; several inflaming the absorbents and absorbent glands; and certain others implicating two or more of these, and often the nerves, arteries, and other structures in addition, the secondary and more remote effects being still more complicated, and the ultimate results being often speedily fatal. Numerous illustrations of what I have now advanced will appear in the sequel, when certain animal poisons come under consideration, and may be adduced from the history of infectious and contagious maladies.

8. 4th. *Poisons may be injected into the large bowels*, either accidentally or intentionally, and produce in this situation their peculiar and even fatal effects. Even certain of them may be thus employed medicinally, and, owing either to the ignorance of the prescriber of their influence in this situation, especially in some diseases and states of vital power and action, or to idiosyncrasy of constitution, their operation may be most dangerous or even fatal. Some injurious substances, when taken into the stomach and mixed with the aliments, are somewhat changed by the action of the secretions, while the primary impression produced by them is thereby impaired or modified, and the absorption of them is delayed or prevented, if, indeed, they be not instantly thrown off by vomiting; but there are many which, when thrown up into the large bowels, act more rapidly and more virulently than if they had been taken into the stomach, owing to rapid absorption often taking place in the large bowels, and to the circumstance of their being less likely to be changed in this situation.

9. 5th. *Poisons have been introduced into the sexual organs*, especially of the female, where they have produced their local as well as constitutional effects, the former of these effects being severe according to the nature and quantity of the substance thus employed, and the latter depending upon the same circumstances. This mode of poisoning, as well as the next,

10. 6th. *The injection of poisons into the uri-*

nary passages, is of rare occurrence; it has, however, been employed both feloniously and accidentally; while the treatment of several maladies of the sexual and urinary organs, by means of injections of various stimulating, astringent, tonic, or acrid substances, has caused, either directly or indirectly, most injurious, or even fatal results, especially when these have been resorted to in cases to which they were inappropriate.

11. II. Of the Action of Poisons.—*Poisons*, according to the definition of the word given above, may act, 1st. *Locally and primarily*; 2d. *Remotely and consecutively*; and, 3d. *Both locally and remotely*. Thus the substance applied either to the external surface, or inhaled into the lungs, or taken into the stomach, may only corrode or inflame the part with which it comes in contact, this effect being so intense as to endanger or even to destroy life. It may produce but little or no lesion or visible change in the part to which it is applied, and yet, through the medium either of the nervous systems or of the circulating fluids and vascular system, it may destroy the individual. And lastly, it may, after having occasioned more or less remarkable local changes, affect the nervous systems, or the vascular system and fluids, or both the nervous systems and the vascular system, with the fluids, secretions, and excretions, thereby destroying life, and sometimes altering even the structure of several of the organs of the body before life is extinguished. Sufficient illustration of these modes of action will appear in the sequel; but I must consider them individually and more particularly, and with reference to the tissues which poisons seem especially to affect, and the channels and media through which they act.

12. i. Of the local and primary Action of Poisons.—Whether or no the injurious action of a substance be limited to the part to which it is applied, or be extended much farther and to distant parts of the frame, it is of moment that we should have some acquaintance, the more intimate and accurate the better, with the nature of the effect produced locally, and with the changes in the constituent tissues of the part.—(*a*) Certain substances, as aconitine, prussic acid, &c., even when applied to an external part, protected by its cuticle, will occasion numbness or want of sensibility, without any other visible change, the local effect thus produced in the *nerves* not proceeding farther, unless the application be protracted or repeated, or the activity of the poison be great, or the cuticle be removed. This effect upon the sensibility evinces not merely a special operation of the substance, but also a disposition or power possessed by it to affect more generally and sympathetically the whole nervous systems, although certain parts of this system may betray the effect in a more remarkable degree.

13. (*b*) Other substances produce a more severe local effect, and yet this effect will continue altogether, or more or less, limited to the part, the injurious operation being caused rather by the intensity and extent of the irritation locally excited than by any other more extended impression or change produced by it. Substances occasioning a local injury or irritation, as mechanical irritants, fragments of broken glass, &c., excite the organic and animal sensibility in the part with which they are brought into contact; and soon afterward the vessels, the capillaries especially, and contractile parts are implicated, and even farther local changes of structure ensue, owing to the effusion of lymph, serum, &c., and to the alterations thereby produced.

14. (*c*) Certain substances, while they benumb the sensibility of the part to which they are applied, also impair the irritability of the fibrous or contractile tissues; and others, while they excite the sensibility, also increase for a time both the susceptibility and the power of contractile or irritable parts, ultimately exhausting these properties, according to the nature and quantity of the substance employed, and thereby showing the intimate connexion existing between sensibility and irritability, and demonstrating that substances which either benumb or excite, or exhaust the one, similarly affect the other. The more active of these agents may thus destroy life by their local effects, especially when they act upon vital organs or parts. Even mechanical agents or irritants, by their intense action locally, and the nature or functions of the organ, surface, or tissue with which they come in contact, may destroy life by their local effects entirely or chiefly. The changes produced by numerous substances are of such a kind as admit of their usual procession being observed. First, the nerves of the part and the sensibility are either benumbed or excited, or irritated, or exhausted, and the contractile property of fibrous tissues similarly affected. Then the capillaries and the contained fluids are implicated, and all the phenomena, either of congestion or of inflammation, with the usual results, are developed, according to the nature of the agent employed.

15. (*d*) Other substances act so rapidly, and produce so general an effect upon the constituent tissues of the part, involving them all in the effect produced, or inducing disorganization with so great rapidity as to render it difficult, if not impossible, to determine the particular element or tissue primarily or principally affected, or to trace the procession of changes. Intense heat and cold, numerous chemical agents, and some septic poisons derived from the animal and vegetable kingdoms, produce this more intense and disorganizing effect upon the part to which they are applied. Some congeal, constringe, desiccate, corrugate, carbonize, or otherwise destroy the structure; and others dissolve, liquefy, or annihilate the vital and physical cohesion of the several textures, which fall into a state of dissolution or pulpy destruction with varying degrees of rapidity.

16. ii. Of the remote or consecutive Action of Poisons.—The primary impression or action of poisons is seldom such as to destroy life of itself, or without producing remote or consecutive effects. If, owing either to the intensity of the local action, or to the extensive disorganization produced in the part, death should quickly follow the application of an injurious or poisonous substance, the effect may be imputed chiefly to the shock received by the vital power, unless the agent acts directly upon a vital organ, whose circulation and functions it is capable of immediately arresting. A corrosive substance, as nitric or sulphuric acid,

&c., taken into the stomach, owing either to its nature or the quantity employed, or to both, causes death in a very short time; but this result is not owing merely to the local action, but to the shock produced by a severe injury inflicted upon an organ supplied by nerves from the organic or ganglial nervous system, and intimately associated in function and organic nervous energy with the organs most necessary to the continuance of life. The local injury is inflicted; the whole body instantly experiences or feels it; the shock, or injurious impression, is rapidly transmitted throughout the whole organic nervous system; and if it be intense, it annihilates not only the vital influence of the organ on which it primarily acts, but also, and through the medium of the organic nervous system, the action of the heart, of the diaphragm, of the lungs, of the brain, &c. Thus the more immediate of the remote effects are produced, sometimes with a rapidity which might lead to the inference that the local impression and the consecutive result are but one operation. More frequently, however, this result takes place with much less rapidity, the primary injurious impression inducing a succession of pathological phenomena, which often admit of due recognition, as they are manifested in either the nervous or the vascular system, or the blood, or the secretions, or the excretions, or in several or even in all these, as will appear in the sequel.

17. It is obvious that, while some injurious agents, from their nature or the quantity, may act either locally or remotely, primarily or consecutively, or in either of these chiefly, there are others which act *in both modes*, either one predominating over the other, according to the agent or agents employed. The mineral acids, in large quantity, or in a concentrated state, act locally, destroy the textures, occasion a general shock of the frame, and even terminate life. In small quantity, or less concentrated, the local action is much less intense, and remote effects are developed, and are such as admit of being traced. Various vegetable or narcotic poisons produce but slight or no apparent local change, yet affect organs remote from the seat of application in a very remarkable manner; and many substances change not only the tissues, on which they primarily act, but also the states of distant parts; these substances even deriving their chief appellations, as acro-narcotics, &c., from their compound properties.

18. III. The Media or Channels by which Poisons act.—It is of great importance to trace the channels through which substances act injuriously on the frame; for the knowledge of these enables us on many occasions to prevent or to arrest the effects produced by these substances. But in order that the media or channels of remote or consecutive effects should be recognised, it is necessary, in the first place, to ascertain the local and primary operation of the substance, the more remote effects of which we are desirous of tracing in the successive changes produced by it. It becomes, therefore, desirable to consider, 1st. *The nature of the local and primary impression produced by a poison.* 2d. *The extent and amount of the sympathetic effect, or of the operation by nervous communication or influence as far as this may be known*; and, 3d. *The organic operation of a poison, or the circumstance of the imbibition and absorption of the substance injurious employed*, and the probable extent or amount of the mischief produced which may be imputed to this mode of operation. As poisons thus act *locally*, *sympathetically*, and *organically*, or in the ways now specified, and as it is obvious that the action of a particular poison is not limited to any one of these modes, although it may operate in either way more prominently than in the others, it may not be superfluous to consider the matter more in detail.

19. i. *The nature of the local and primary impression produced by a poison* is not always readily ascertained; for, owing either to the quantity or the intensity of action of the substance employed, the several constituent systems and tissues of a part may be so instantly and generally impressed and altered by that substance as not to furnish distinct evidence of the tissue primarily affected, as I have above contended; but in other circumstances the local changes, as well as the consecutive effects, often admit of analysis, although sometimes imperfect, the results necessarily varying with the circumstances of particular cases.

20. *A.* The *nerves* of the part, whether the organic, the sensory, or the motory, are evidently primarily affected according to the texture to which the poison is applied, or are the first to manifest the effect, unless the substance be such as rapidly to change the organization of the structure; and according as either of these orders of nerves is implicated or impressed, so will the secretions, the sensibility, or the movements of the part be affected.

21. *B.* The *irritability* of contractile tissues is also altered by poisons, more especially by those which change the state or functions of the organic nervous system. If what I have contended for in the article Irritability, namely, the dependence of this very prominent vital property upon the organic nervous influence, be admitted, it necessarily follows that this property will be co-ordinately affected by whatever changes the state of this influence; and a close investigation of the operation of many poisons proves that those substances, as certain animal poisons, which inordinately depress or altogether annihilate this influence, affect the irritability of the contractile tissues in a similar manner and in a co-ordinate degree.

22. *C.* The *capillaries and vessels* of the part must also be changed, as regards their vital properties, whenever the organic nervous influence and irritability are affected; and the change of these vessels must be necessarily similar, as to kind and degree, with that primarily produced in the organic nerves and contractile tissues. There is every reason, also, to believe that the change is not limited to the capillaries and smaller vessels, but extends more or less manifestly to the contents of these vessels, more especially to the red globules and to the fibrin of the blood which they contain; the condition of the former constituent of the blood in these vessels, and the quantity or state of the latter, being always very materially altered by the morbid impression made upon the organic nervous influence and irritability of the part, and upon the vital properties of the capillaries, the physical and chem-

ical characters of the blood in these vessels being thereby thus rapidly changed.

23. *D.* The alterations thus produced in the organic nervous influence, in the irritability, in the state of the capillarics, and in the contents of these capillaries—in the blood—of a part to which a poison has been applied, must necessarily soon be followed by farther changes in the whole of the tissues constituting the part—in its *whole structure*—and these changes will be rapid, extensive, and diversified in character, according to the nature of the poison, and as it acts prominently upon either the nerves, or the capillaries, or the fluids, or the other constituents of the part, or in any of the particular modes which will come under consideration in the sequel.

24. ii. *The sympathetic operation of poisons*, or the action of a poison on parts remote from that to which it is applied by means of the nervous system, or by any of the orders of this system—the organic, the sensory, and the motory—evidently obtains to a very considerable extent, especially as respects the action of some poisonous substances; but, as this medium of operation is not the only one, and as it is frequently associated with that about to be considered, namely, the blood and vascular system, either channel being more or less operative in producing the remote effect, according to the nature of the substance and state of the system, it is often difficult to determine the precise extent to which either contributes to the ultimate result. It will, however, be shown in the sequel, that certain substances, when taken into the stomach, or injected into the bowels, or otherwise brought into contact with parts supplied chiefly with the organic or ganglial nerves, have not merely the sensibility of these nerves excited, but also the involuntary movements of parts distant from that to which the substance was applied remarkably affected, owing to the local irritation being transmitted through the medium of this order of nerves, and the connexion of these nerves with nerves of sensation, and with the roots of the spinal nerves; and, farther, owing to this connexion, the effects are often extended to the spinal cord and to the brain, and thence reflected upon voluntary muscles and the extremities of the body, the resulting phenomena varying with the nature of the injurious agent and the temperament and constitution of the person poisoned by it. It is unnecessary to illustrate this topic at this place, as it is fully discussed in the articles Irritation and Irritability, and especially in that on Sympathy or associated morbid states.

25. iii. *The organic operation of poisons*, or the imbibition and absorption of them, or the action of them through the media of the circulating fluids, as the lymph, the chyle, and the blood, is one of the most important ways in which the effects of these substances are produced. Still, this way is not always the same, the route varying with the organ or part to which the poison is applied, and with the nature and action of the particular poison employed. The imbibition or endosmose of some substances through membranous tissues is often much more rapid than that of others; but much depends upon the physical state of the poison, and concentration of the solution of it employed, and other circumstances. The passage of some substances into the blood, when either applied to a mucous surface, or to a surface denuded of its cuticle, or epithelium, or introduced into a wound, is often much more rapid than might be supposed, if the fact had not been demonstrated by experiments. Nevertheless, the rapidity of the introduction of certain poisons into the circulation has been, according to a few observations I have made, overrated by some writers, who have considered that the passage of a poison into the blood may take place in a very few seconds. It will certainly occur in much less than a minute in some cases; but I doubt the extreme rapidity contended for by some physiologists. Great rapidity of absorption is observed chiefly as respects certain saline or virulent vegetable and animal poisons, which are readily imbibed by the capillaries and carried into the blood. Substances which are absorbed by lacteal or lymphatic absorbents act much more slowly, and several of them require a considerable period before they reach the blood, especially if the vessels which have absorbed them pass through glands; and when this is the case, the glands are often affected, and in some instances, when the poison is not very virulent or rapid in its operation, the glands either altogether arrest or delay, for a longer or shorter time, the progress of the mischief.

[It is now generally conceded that poisons are not instantaneous in their action, but that sufficient time always elapses between the application of a poison and the first symptom of its action to admit of its contact with the tissue which it affects. Thus, hydrocyanic acid requires, according to Professor Blake, of St. Louis, eleven seconds before it will take effect, when applied in large quantity to the tongue of a dog; and death does not occur under thirty seconds. He found fifteen seconds elapsed after ten drops of *conia* had been injected into the femoral vein of a dog, before symptoms of the action of the poison appeared; and death did not occur until thirty seconds after the injection. Dr. B. has also showed that the time required for a substance to be absorbed by the capillaries and diffused through the body, may not exceed nine seconds. The same experimenter has proved that the celerity of action of any poison is in a direct ratio with the rapidity of the circulation: a fact of great importance as connected with the *modus operandi* of medicinal as well as poisonous agents.]

26. The poison having been carried into the circulation either by the lacteal absorbents, or by the lymphatics, or by the capillaries and veins, according to the seat or part to which it is applied, and the action which it exerts on the constituent tissues, produces ulterior effects, which are about to be briefly considered, owing to its action, 1st, on the blood itself, in which it mixes, and which it contaminates; 2d, on the blood-vessels and heart; 3d, on the nervous ganglia and plexuses; 4th, on the spinal cord and the sensory and motory nerves; and, 5th, on the brain and organs of sense.

27. iv. Those poisons which act more or less *chemically* are most readily imbibed, are absorbed most directly and rapidly, and change not only the physical characters, but also the chemical constitution of the blood, as far as we are acquainted with that constitution. They

change the colour, and there is reason to suppose that they affect also the organization of the red globules; they alter or diminish the fibrin, and variously affect the saline and albuminous constituents of the blood. But there are few of those substances which act thus chemically upon the blood, especially alkalies, acids, and numerous neutral salts, that do not also affect the vital condition of this fluid, and change this condition and its chemical constitution both in relation to each other, and in connexion with the vessels and heart, and with the nervous centres, more particularly the nervous system actuating the circulating apparatus.

28. IV. General Effects of Poisons.—i. *Some substances or agents depress nervous influence and vascular action*, and thereby lower vital power; the depression being either relative or absolute, and varied in its effects, according to the agent and the quantity, intensity, or duration of its operation. The application, for instance, of cold, or, more correctly, the abstraction of vital caloric, when moderate or of short duration, or acting upon a surface or part only of the body, depresses vital action in that part during its continuance; but reaction takes place when the depression is limited as to seat and time, owing to the determination of the circulation to more internal or to vital parts, or when muscular action accelerates the flow of blood in the vessels. But when cold, owing to its intensity or continuance relatively to the state of the system while exposed to it, renders torpid the organic nervous influence, and retards or interrupts capillary and venous circulation through a considerable extent of the frame, reaction may not take place, or may occur so imperfectly or irregularly as not to relieve internal congested organs; and if it occur, it may be attended with, or develop inflammation in some predisposed organ.

29. There is, perhaps, no other agent which tends so completely to depress both the nervous and vascular functions, so as even to overwhelm them altogether, as cold, when it acts either intensely or for a long period relatively to the constitution and circumstances of those subjected to its influence, or when it exceeds in grade that which has just been stated to admit only of imperfect reaction. Like other agents, therefore, cold is either a tonic, a sedative, or destructive of life, according to its grade and the manner of its operation on the living economy; but there is scarcely another physical agent whose sedative effects are so equally manifested upon all the general systems and functions of the frame, and without directly producing some other operation, unless the respiration of air, loaded with carbonic acid, or with sulphureted hydrogen, or prussic acid used in any form, be exceptions. Aconite and colchicum are sedatives to the sensory and organic nerves especially, but they also irritate the surfaces to which they are applied; and digitalis and tobacco act chiefly on the heart and vascular system, without materially depressing the nervous functions of animal life, or the functions of the brain and spinal cord. When, however, these, or other substances, which produce a general sedative or depressing effect, as respects nervous influence and vascular action, are exhibited in large or injurious quantities, their subordinate operations are then so masked as to escape notice, or are so inconsiderable as not to deserve attention. Certain poisons, which produce a narcotic effect upon the nervous system, when given in moderate doses, exert a sedative influence upon the vital actions generally, when taken in still larger or poisonous quantities, as shown by opium, belladonna, conium, hyoscyamus, &c., when so exhibited.

30. The sedative effect, when it becomes injurious, is generally not limited either to the part to which the agent is applied, or to a particular system or organ. Besides depressing nervous power in the surface or viscus to which a sedative poison is applied, and causing capillary and venous congestion, the morbid impression is propagated along the nerves to more distant parts, especially to the nervous centres, while the poison itself is partially absorbed, and, mixing with the blood, it acts directly upon the nervous masses, and more or less, also, on various organs, according to its specific influence. This being the general effect—the result being depressing, and ultimately destructive of organic nervous power and vascular action, with varying degrees of rapidity, according to the nature of the poison and the quantity employed—it may be imputed, according, also, to the nature and quantity of the agent, to either of these channels or media principally, or to all of them, although in different grades, the fatal or injurious operation arising through these sources singly, or conjointly, but in varying proportions.

31. ii. *Some poisons inordinately excite nervous influence and vascular action*, or stimulate vital power for a time. Heat and oxygen are the most influential agents in producing this effect, and they perpetuate it perhaps longer than any other without exhausting vital action, especially upon withdrawing them. Alcohol, the ethers, ammonia, and numerous other stimulants, may become poisons when exhibited in large quantities, or when long employed, owing partly to their effects locally, but especially to their influence, through the media of the nervous and vascular systems, and of the blood, upon the nervous masses or centres, and upon the liver and excreting organs. It is seldom, however, that stimulants destroy life before they have induced either exhaustion co-ordinate with the stimulating action, or effusion to an amount sufficient to interrupt the functions of a vital organ, or alterations of the circulating fluids incompatible with the continuance of the nervous functions or of the heart's action, or even inflammatory or structural changes of some important viscus, or some two or more of these changes.

32. iii. *Exhaustion of organic nervous power, and of sensory and motory influence*, or of vital energy generally, is one of the most manifest general effects of substances given in quantities sufficient to destroy life in a short time. This exhaustion is especially remarkable when it is caused by substances which injuriously impress the nervous systems, or which act so rapidly as to render it difficult to determine whether the impression of the agent be transmitted by means of the nerves to the heart and brain, or whether the substance is itself absorbed into the circulation, where it directly

acts upon these organs, or whether it acts in both ways. Poisons which may be said to kill by exhausting the vital actions must necessarily be considered as having first produced an excessive stimulating effect, which has so rapidly passed into exhaustion as to leave the primary operation unobserved or even unobservable, for exhaustion implies antecedent stimulation. Nevertheless, if the operation of many of the substances which are generally said to destroy life by exhausting vital power, when given in large quantities, be considered with reference to their effects upon the living economy in small doses, it will be found either that the quantity which is stimulating is very small, or that the stimulating operation of the substance, even in such quantity, is very equivocal; and, if it may be admitted to exist, it rapidly lapses into a distressing or peculiar form of exhaustion, as may be allowed in respect of tobacco and various narcotics. From this it will appear that the poisonous effect of the same substance may be imputed by one person to the powerful sedative effect it had produced in the quantity or dose in which it had been given, and by another to the extreme exhaustion consequent upon a great and rapidly evanescent stimulation, &c., according to the views each may entertain of the physiological action of the substance in question.

33. iv. *The general effects of poisons cannot be viewed as merely dynamic: they also alter or change the states of nervous influence and of vascular action.* Those substances which prove rapidly poisonous, owing to their nature or the quantity taken, evince the dynamic operation more remarkably. This may, however, be owing to the circumstance that the dynamic action is much more recognisable than any change in character or kind of action, during the short period intervening between the impression of the agent and a fatal result. It is chiefly such poisons as act slowly, or some of those which are more virulent, but which, when taken in small quantities, are not rapidly fatal, that produce more or less manifest alterative effects. Still, these effects are not solitary; they are generally associated with one or two of the general effects already noticed, and also with certain others, which are more specific, or which appertain to the poison in question, and in some respects characterize its operation when employed either medicinally or otherwise. The alterative effects of poisons being recognised with difficulty, in connexion with other more general and remarkable results, unless the operation is slow, and as these effects are more peculiar or specific, and, at the same time, more complicated, I shall proceed to consider them more in detail, and endeavour to analyze them, or show their more special influences, although I cannot do so at this place in so full and satisfactory a manner as I am desirous of doing.

34. V. The special Operation of Poisons.—It is obvious to the experienced observer of the operation of the more active agents of nature upon the living economy, that very few act in one unvarying manner, or that any one of them produces a single effect, or acts solely upon a single function or part, without also affecting others more or less. All that such an observer of the more special actions, either of medicines or of poisons—and most of the former possess the latter property—can expect, is this, that, although any one of these substances produces certain general results, and extends its influence more or less to different functions and even to remote organs, some particular surface, function, or viscus; some one of the chief factors of life, or of the constant actions and results which these factors produce; some of the manifestations of life in particular tissues, systems, organs, or parts, will be more prominently affected than others, or be chiefly, but not solely, changed by the action of that substance. In the analytical survey I am about briefly to take, it must, therefore, be considered, that the special action of any single poison is not confined to the production of one only of the several effects which I shall have to notice under the separate heads which the analysis furnishes; but that it extends to more than one system or viscus, although some one manifests it much more than another, and alters certain vital properties and functions, or a particular property or function, more than others. When the symptoms and changes produced by individual poisons, and the modes of obviating and removing these changes, come under consideration, then the associated and even complicated nature of these changes will he made more evident.

35. i. *Some injurious agents abstract the caloric, or depress the vital calorific process not only in the part to which they are applied, but also throughout the body.* This effect may be produced by the application of cooling substances, or by whatever lowers the organic nervous influence and vascular action, or by both modes of action produced either simultaneously or in rapid succession. A large quantity of cold water or of ice taken into the empty stomach, especially when the system is exhausted by fatigue, or when the body is perspiring freely, may not only abstract the animal heat from parts requiring a certain elevation of temperature for the performance of their functions, but also depress the organic nervous influence actuating these parts, so as to produce capillary and venous congestion, or an arrest of the circulation, and other consecutive effects, until the action of the heart ultimately ceases. Although cold fluids may destroy life very rapidly when taken largely in these circumstances, in the manner now stated, and owing to the influence of cold upon vital actions, as noticed above (§ 28, 29), yet there are hardly any substances which are poisonous owing chiefly to this mode of action, although there are several which, when employed in large or frequent doses, produce a refrigerating and depressing effect along with other changes of a more prominently injurious nature, more especially the hydrochlorate of ammonia, the nitrate of potash, and various other salts and dilute acids, which not only depress the calorific process, but also chemically and physically affect the blood and vascular system, and through this medium the nervous system also.

36. ii. *Certain poisons act more especially in destroying the sensibility, or the functions of the sensory and of the organic nerves*, in benumbing, depressing, or suppressing sensibility, and the organic nervous influence. Of these the most remarkable are monk's-hood and its active prin-

ciple aconite, cold; ether and alcohol, when absorbed or injected into the blood, or when their vapour is inspired; belladonna, conium, morphia, and most of those which have been denominated narcotics, sedatives, and stupefacients. But these produce also a paralyzing effect, remarkably depress the organic nervous influence, diminish irritability, impede secretion and excretion, or even irritate the mucous surface to which they may be applied, as colchicum, tobacco, hyoscyamus, opium, &c. [*Chloroform* is another very active poison, which may be ranked under this head, as it exerts a directly depressing influence over the heart and cerebro-spinal system of nerves; and if breathed for a few minutes, would inevitably destroy life.]

37. iii. *Other poisons more prominently paralyze the organs of voluntary motion, while they impair the irritability of involuntary parts, diminish sensibility, and depress the organic nervous influence*, especially hemlock and its alkali, conia, hydrocyanic acid, and the cyanides, carbonic acid, sulphureted hydrogen, &c.; stramonium, cannabis indica, tobacco, digitalis, the preparations of lead, &c.

38. The substances which act energetically upon the nervous system, in impairing either the sensibility or the irritability and the voluntary movements of muscular parts supplied by nerves respectively belonging to these systems, have not their actions limited to one of these functions only, although either may be more prominently affected according to the poison employed. Their effects may, moreover, be extended even to secreting and excreting organs, such poison acting more or less on particular functions than on the others. When either of these substances is taken into the stomach in quantities which are injurious, not only are the nerves of the part affected, but absorption of the poison takes place to a certain extent, and the injurious impression made upon the nerves by it is transmitted along the organic and sensory nerves to the ganglia, brain, and spinal cord, which are farther affected according as the substance is present in the circulation. Some of these poisons seem to affect one order of the nervous system more than another; certain of them impress more especially the organic or ganglial nervous system, deranging the several functions depending chiefly upon it; others affect the brain, consciousness, and sensibility, and impair more or less the voluntary movements and other allied functions; and these several results are, moreover, varied not only with the quantity of the poison taken, but with the circumstances connected with its exhibition and the constitution and temperament of the person who is its victim.

39. iv. *Certain poisons produce a septic action, weakening and dissolving the vital cohesion of tissues, or softening and even liquefying the structures.* These substances not merely depress the organic nervous energy of the parts with which they come in contact, but they also produce a physical or chemical change in the tissues, contaminating the fluids, and favouring the imbibition and absorption, not only of the poison itself, but of the contaminated fluids of the poisoned part. Animal matters act chiefly in this way, more particularly the poisons of serpents, of fish, decomposing or putrid animal substances, the animal poison generated in sausages and preserved or dried meats, the secretions and fluids in disease, or after death; especially after malignant and infectious maladies, and still more especially if any of these be applied to a punctured wound, or to an abraded surface. In most instances the local action of these poisons is evinced by the part being pained, swollen, livid, or otherwise discoloured, soft or boggy, sometimes numbed, and changed in temperature, often rapidly passing from a burning heat to coldness, or being cold from the commencement. These changes proceed from the extremities to the trunk, from the periphery to the centre, and extend more or less rapidly, with remarkable sinking of vital power, a very quick or irritable pulse, and manifest indications of contamination of the fluids and soft solids, more especially when the poison has been applied to an external surface, or to a wound. When it has been taken into the stomach, distressing nausea, vomiting, anxiety, and feeling of sinking, evidently owing to depression of the organic nervous energy, are then generally observed, with other symptoms varying with the particular poison which has been taken, as cutaneous blotches or eruptions, coldness of the surface, suppression of urine, rapid, weak pulse, watery stools, &c., &c.

40. The animal poisons which act in the way now described affect chiefly the *vital conditions* of the parts to which they are applied; depress organic nervous influence, and loosen the vital cohesion of the tissues, while they contaminate the fluids; but there are other substances, which soften or liquefy the tissues, in consequence rather of a *chemical* than a vital operation, although the vital conditions are also to a certain extent affected. These are the *alkalies*, the sub-salts, or those saline substances in which the alkali is the predominant element, the biborate of soda, the iodide of potassium, the alkaline sulphurets, the preparations of antimony, of mercury, &c., when used in large quantity or long employed. These substances act locally, more or less energetically, as now stated, especially the pure alkalies; but they are also rapidly absorbed, and they then alter the vital conditions of the nervous and vascular systems, and the chemical constitution of the blood, especially as regards the red globules and fibrin, the proportions of which they even diminish, especially when they have been employed for a considerable time. When thus used, they also liquefy, and favour the absorption of morbid growths or tumours, while they relax generally the soft solids.

41. v. *That various poisons excite the ganglial, spinal, and sensory nerves, or either of these orders of the nervous system, more than the others*, will be admitted; but this effect is generally varied and associated, according to the nature of the particular substance employed, with other changes manifested by secreting surfaces and organs. The stimulating operation is evidently exerted primarily upon the nervous organization of the part to which the substance is applied; and for a time it tends to concentrate the nervous power, and even vascular determination and action, towards the surface or viscus thus acted upon. Subsequently, however, the effects become more or less diffused; but the rapidity of the diffusion of the stimulating influence over

the frame depends upon the nature and quantity of the substance employed, the state of the organs upon which it has acted, and the temperament, constitution, and habits of the subject acted on. The principal question is, whether or no the general or remote effects are produced by nervous influence, or by the rapid passage of the substance into the circulating fluids, and the consequent operation of it upon the several organs and structures of the frame, or by both these modes, either of them predominating according to the circumstances just stated.

42. *A.* As to the action of stimulants on the nervous system, on either the ganglial, the sensory, or motory, or upon any two or all of these divisions of the system, there can be no doubt as respects that part of it supplying the organ to which the poison is applied; the question being as to the extension of the stimulating operation to distant parts by means of this system. Formerly, the remote effect was imputed altogether to this system, the other mode of action just referred to being overlooked or discarded. From 1819 until 1826, I made many experiments with stimulating substances and tonics, vegetable and mineral, some of which were published in the journals of the day (especially in the London Medical and Physical Journal, and London Medical Repository), with the view of determining the modus operandi of many active agents upon the frame; and I demonstrated beyond dispute that this is not the only mode of action, as regarded the great majority of them, which, although acting more or less in this way, operate also, and even mainly, through the medium of the circulating fluids.

43. That the stimulating impression made upon the organic or sensory nerves of the viscus to which the substance is applied is transmitted, more or less remarkably, by means of these nerves to remote parts, which it thus affects, appears extremely probable; for there are several analogies, considerations, and even proofs, both physical and pathological, of this being the fact; and, moreover, these remote effects are often reflected upon other distant parts. Thus the stimulus existing in, or acting upon, an internal viscus, may be transmitted by the organic nerves to the adjoining ganglion, or to the great semilunar ganglion, or to the spinal cord, or to the brain, becoming an object of either obscure or distinct sensation or consciousness, and there the effect may cease, or be reflected thence upon other parts, affecting the actions of involuntary organs, through the media of ganglial nerves, or exciting the movements or sensibility of voluntary parts through the medium of the spinal cord. The remote effect may be produced more or less by either order of nerves or nervous masses, ganglial, cerebro-spinal, or sensory and motory, according to the nature and quantity of the substance employed, and the mode of employing it. Much of the misconception and confusion which have existed as to the operation of agents on and through the medium of the nervous organization have arisen chiefly from the following circumstances: 1st. Experimenters have considered the organic nerves as forming a part of those proceeding from the cerebro-spinal axis; 2d. They have viewed the distinct orders or divisions of the nervous system as identical, and as performing the same functions; and, 3d. They have overlooked the fact that it is impossible to separate the vascular system from the nervous, so as to isolate each, and that it is equally impossible to cut off the nervous communications existing in distant parts while the arterial communications are allowed to continue, inasmuch as all arteries are surrounded by a reticulum of ganglial nerves. It is owing mainly to these circumstances, and their consequences, that so many ill-planned and ill-performed experiments on living animals have been made; experiments which could furnish no correct inferences, which, moreover, were undertaken to decide points not admitting of being thus decided, and which could not prove the basis of even a loose hypothesis, far less of sound doctrine. Considering, therefore, as will appear more fully in the sequel, that poisonous as well as medicinal agents produce an impression upon the nerves of the part to which they are applied, that is not limited to such part, but which often affects sympathetically distant parts, although in various degrees and modes, according to the nature and state of the substance employed, I proceed to remark upon the operation of stimulants through the medium of the circulation.

44. *B.* That numerous stimulating substances —vegetable, saline or mineral, and animal—are more or less rapidly imbibed by the tissues, and absorbed into, and are afterward eliminated from, the circulation, are among the best established facts in physiological science. The effects which these substances produce, when taken either medicinally or in hurtful doses, are chiefly owing to this mode of action, although the impression primarily made by them on the several divisions of the nervous system is also more or less influential in producing these effects; but the exact extent of that influence can hardly be determined. That the majority of stimulating substances are actually absorbed into the circulation, to an extent varying with the substance employed, and the state and mode of its employment, has been fully established, inasmuch as they have been detected in the blood itself, and in the several secretions and excretions. The special operation of many stimulants thus depend not only upon their primary impressions upon the nervous system, but also upon their presence in the blood, and their action on the nervous masses and centres, and more specifically upon the functions of certain organs and surfaces, particularly upon those organs by which they are eliminated from the blood. The alcoholic, the ethereal, the balsamic, the camphoraceous, and several other classes of stimulants, both vegetable and mineral, act in the way now stated.*

* During 1819, 1820, and 1821, I made a number of experiments upon the operation of several active substances; and the results of those which I made with the terebinthinates were published in the *London Medical and Physical Journal* for July, 1821. At that time it was generally believed that medicinal as well as poisonous substances acted upon the nervous system directly and entirely, the results depending altogether upon this system, without reference to the blood and vascular system, and without distinction between the organic, the sensitive, and the motory divisions of the nervous system. I believe myself to have been, if not the first, at least among the first, to determine by experiments the action of these substances through the medium of the blood, and to show that many of these substances act differently upon the different orders of the nervous system; upon the organic nerves either chiefly, distinctly, or differently from their action on the cerebro-spinal. (See *Lond. Med. and Phys. Journ.*, July, 1821, p. 112, *et seq*, and August, 1821, p. 185, *et seq.*)

45. vi. That many poisonous substances are *capable of astringing the tissues and of increasing the tone or vital cohesion of certain structures, when employed in small quantities, cannot be doubted*; but this effect more rarely follows their employment as poisons, unless in the case of mineral poisons; and then the operation of these, especially when used in large or injurious quantities, is more chemical than vital; several of them, as the mineral acids and salts, combining to a certain extent with the tissues and the liquid elements of the tissues, altering the constitution of the capillaries and of the capillary contents, and thereby affecting the state of vital function and action. Many of the substances which act as stimulants, by the greater permanency of their effects, and by their action, in the manner now stated, upon the tissues, have an astringing operation. Substances acting thus on the economy have not their effects always limited to the parts to which they are applied; for I have ascertained that they are absorbed, especially when much diluted, or when dissolved, into the circulation, and are afterward carried out of it chiefly by the kidneys and skin. The metallic salts and the mineral acids severally act in this way more or less rapidly, energetically, and manifestly; and produce their effects on parts of the frame the most remote from those to which they were applied. The metallic sulphates and nitrates, the superacetate of lead, the balsams and resins, the phosphoric, the mineral, and many of the vegetable acids, although acting in the way now stated, severally produce other effects, when employed in hurtful quantities. Some of them excite certain of the organs concerned in excreting them from the circulation; others of them depress or exhaust the organic nervous influence and the irritability of the heart and other contractile parts; and many of them alter the constitution of the blood, especially of the red globules and fibrin, so as to render this fluid unsuitable to the perpetuation of the nervous and vital functions.

46. vii. *Numerous substances act especially upon the irritability of contractile parts, and either impair or increase this vital property*, according to the nature of the substance. These modes of action evidently result from the impression produced either primarily upon the organic nerves of the part, or consecutively upon the ganglia, the poison having been carried into the circulation, or from both these modes of operation. Prussic acid and the prussiates, monk's-hood, tobacco, aconite, digitalis, arsenious acid, colchicum, antimonials, borax, and boracic acid, ergot of rye, nitre, and several other substances, when employed in large doses, *depress* the organic nervous power, and the irritability of involuntary organs, especially of the heart, without directly impairing the functions of the brain and spinal cord, and of voluntary parts, although affecting them through the media of the ganglial and vascular systems. Other substances affect the irritability by increasing it at first and *exhausting* it afterward, the effect varying with the substance and the quantity employed. This operation probably obtains in respect even of some of the articles just enumerated, as arsenic and antimony. Other substances *excite* the irritability of both voluntary and involuntary organs more or less remarkably, as nux vomica and strychnia, brucia. St. Ignatius's bean, snake-wood, [the different species of rhus], &c.

47. viii. *Numerous articles act more especially in augmenting certain secretions and excretions*; and they produce these effects either by their direct action on the organs to which they are applied, or by their consecutive operation, through the medium of the circulation, upon the organs and surfaces which they specifically influence. Thus, emetics and purgatives taken into the stomach excite or irritate the organic nerves supplying the villous surface of the alimentary canal, and thereby increase the secretions and involuntary movements of the tube, each substance possessing either an emetic or a purgative property acting in a manner more or less peculiar to itself, and producing, moreover, in some cases, additional effects. Other substances, as many of those which act upon the kidneys, as the terebinthinates, several salts, particularly the nitrate of potash, the nitrate of soda, the acetate of potash, cantharides or its active principle, and various other articles, are absorbed into the circulation, and excite especially the kidneys, so as to increase their secretion, or even to over-excite or inflame them. Other substances, through the medium of the circulation, affect the exhalations and secretions from the bronchi; and others, again, those from the skin. But this subject need not be farther pursued at this place.

48. ix. *That some articles irritate particular organs or parts in a way more or less peculiar to these articles*, either when directly applied, or absorbed and carried in the blood to the organ affected by them, may be admitted. But although this operation, and those just noticed, constitute the chief modes in which substances are expected to act medicinally—their principal therapeutical effects—yet they are merely subordinate to the more energetic or violent results produced upon the nervous influences and vital actions, when the same substances are employed in hurtful quantities.

49. x. *In connexion with this irritating operation, varying with the substance employed and the mode of its employment, an alterative action is also produced; the vital functions, the secretions, the sensible qualities and conditions, and the nutrition, of particular organs and parts being changed in kind or character, as well as dynamically or in degree.* These effects are manifested chiefly when poisonous substances are given repeatedly in small doses, are employed medicinally, or with the view of producing deleterious effects slowly and latently. Numerous medicines have acted injuriously in this way, as well as in the two preceding modes, in consequence of having been employed injudiciously; inappropriately as respects the nature of the disorder, and either during too long a period, or in too large or too frequent doses, the effects thereby produced having been mistaken for the progress of the disease. When substances have thus produced an alterative effect or change of action in any one or more organ or part, they have generally been absorbed to a greater or less extent into the circulation, and have operated, through the medium of the blood, on the tissues, or on the organs eliminating them from the system.

50. xi. *Substances which irritate or excite inor-*

dinately the parts or tissues to which they are applied, determine or solicit increased circulation and vital action to these parts, and proportionately diminish vascular action in distant parts, or in the viscera less intimately connected or associated in function with those on which these substances act directly. Many articles are employed medicinally with the intention of producing these effects, as *revulsives*, *derivatives*, or *revellents*; and many of the phenomena observed as consequences of poisoning depend upon this revulsive or derivative operation. This effect arises chiefly from the influence of the organic nerves, which, when irritated, influence the circulation in the associated capillaries and arteries, increase the vital expansion and action of these vessels, and augment the exhalations and secretions from them; the results varying, in kind and in grade, with the irritant or substance thus affecting the organic nerves of the part to which the increased action is thus determined.

51. VI. The Circumstances which modify the Effects of Poisons require to be briefly noticed.—(*a*) The *quantity* used materially affects the action of a poison, so much so that the most virulent poison is medicinal, or even salutary, when taken in minute doses. Thus prussic acid in a very small dose is soothing and antispasmodic, in a large dose it annihilates the vital action. Several poisons, in small quantities, slightly irritate or inflame the digestive canal, but in larger doses they produce convulsions, coma, and death.

52. (*b*) *The aggregation and degree of dilution* very materially modify the operation of a poison. The more minutely a deleterious substance is divided, and the more completely it is dissolved in oil or in water, the more energetically and the more rapidly it will act, especially when taken into the stomach. This necessarily follows from the preparation thus made for the action of the poison over a large surface, and for the imbibition of it by the tissues and absorption by the vessels. Certain substances, which are extremely active when thus prepared, remain for some time inactive when they have been taken in a concrete or aggregated state. The dissolving influence of the juices of the stomach, and of the secretions poured into the duodenum, is not without influence upon certain poisons, when taken in an undissolved state; for the carbonate of barytes and arsenite of copper are more soluble in these than in water. The operation of poisons is farther changed by aggregation and by degree of dilution. Camphor, in weak dilution, is cooling, sedative, and soothing; in stronger dilution in oil, or minutely divided in mucilage, it is exciting; and, in still larger quantity, productive of deliriuni, coma, or convulsions; and in fragments it may occasion inflammation, or even ulceration of the part to which it is applied. Certain poisons in a state of vapour, or even substances which cannot, in their usual states, be viewed as poisons, when employed in a state of vapour may become poisonous, if they be applied to extensive surfaces of the frame. Thus the inhalation of the vapour procured from numerous ascertained poisons, narcotics, and others; or of the vapour of ether, of alcohol, [of chloroform], and of certain volatile oils, when continued even for a short time, rapidly affects the frame, owing to the remarkably great extent of living surface to which substances in a state of vapour are thus directly applied, to the extent of the impression produced by them on the organic nerves, and to their rapid absorption into the circulation.

53. (*c*) *Chemical conditions or combinations*, and the states in which chemical substances are employed, modify the effects produced. Some chemical substances, when employed in a concentrated state, act locally merely, as the mineral acids; but when taken internally in a state of weak dilution, they are carried into the circulation, and act upon and through the medium of the blood. Morphia, being insoluble, is comparatively inert, unless very minutely divided, but when dissolved in a fixed oil, or in alcohol, or combined with an acid, it becomes very active; and numerous substances which, in an uncombined state, are most deleterious, become innocuous when chemically combined with their opposites, as alkalies with acids, and *vice versâ*. But this topic is so trite that I need not pursue it farther.

54. (*d*) *Admixture* of various substances, alimentary or others, either before or after ingestion, varies the effects; generally by diminishing the activity of the poison, owing to slow absorption and imperfect or intercepted contact with the villous surface of the stomach. If, however, the poison be taken in a state of complete solution, and if the substances taken with it, or those already present in the stomach, serve to dissolve or minutely divide it, they may not impede, but, on the contrary, ensure its action. If it be swallowed in a state of imperfect division or in fragments, the alimentary or other substances given with it may so involve these particles, or the mucus of the surface may so protect the organ, as either to diminish its effects, or to occasion vomiting, by which it may be altogether or partly thrown off. Dr. Booth has recorded an instance of an ounce of corrosive sublimate having been swallowed after a full meal, without any remarkably bad effects having been produced, full vomiting having been speedily induced; and other cases are referred to by Dr. Christison (see above, § 3).

55. (*e*) *The organ or tissue* to which a poison is applied has been already stated materially to influence its action on the economy, both locally and generally (§ 3–10). It has also been stated that the cuticle protects the skin more or less from the action of poisons, even the most corrosive and subtile; and it is not until it be removed or destroyed that the poison acts, or if it act, the effect is much more slowly produced. The mucous surfaces are much more readily acted upon: still the mucus and epithelium covering them protect them to some extent, and render them less susceptible of the poisonous impression, and less prone to imbibition and absorption, than serous surfaces, or denuded or incised parts. These latter parts, or wounds of any description, may, however, escape, if they bleed so freely as to wash away the poison. The rapidity of action varies much with the tissue to which the poison is applied; and is manifestly attributable to the celerity with which absorption proceeds in such tissue, and the extent of surface presented to the poison. Thus it is very rapid when a fluid poison is injected into the bronchi.

56. It is worthy of mention, as remarked, but

not explained, by Dr. Christison, that the poisons which seem to operate energetically on the sentient extremities of the nerves, and indirectly through the brain and spinal cord, act not at all upon the divided surfaces of the brain and large nerves, or upon the course of the latter; as proved in respect of prussic acid, opium, strychnia, and several narcotics. This circumstance may be partly owing to the mode of operation of poisons above contended for, viz., upon the organic nerves, or the organic and sensory nerves chiefly; the application of them to a cut portion of the fibrous structure of the brain, or of a nerve, not being likely to produce any farther effect than what may arise from the division of certain fibres of these structures. The effects of poisons on different parts depend much upon the vascularity and the disposition to imbibition and absorption possessed by the texture to which the poison is directly applied. The connexion also subsisting between the texture and the more vital organs, especially the dependence of the part upon the organic nervous system; the state of the vessels, the amount of hæmorrhage from them, and a variety of circumstances, also modify the results.

57. Mineral and vegetable poisons are much less controlled or influenced in their action by the organ or tissue to which they are applied than animal poisons are. The digestive canal and its secretions change the usual operation of mineral poisons but little; some vegetable poisons are somewhat more modified by the digestive organs in certain cases; but several animal poisons, which, if applied to a denuded surface, or to a wound, would be rapidly fatal, may be so altered by these organs as to be productive of but little disorder when taken internally.

58. (*f*) The operation of various poisons, especially of narcotic and sedative substances, is modified, also, by *habitual use* of them, and by *idiosyncrasy*. While use diminishes the poisonous effect, idiosyncrasy more commonly increases it. A person who has become addicted to opium, or even to some other narcotics, may take as much at once, with advantage, as would destroy the life of a person not accustomed to the substance; and a person may be almost poisoned by a substance, or an article of diet, as a particular kind of fish, that would not disorder others. The influence of habit, or use, is shown chiefly by the organic poisons, particularly those already mentioned. Inorganic or mineral substances have not their injurious operation so remarkably impaired by use. Dr. Christison supposes that this "effect of habit is nothing more than an increased power acquired by the stomach of decomposing the poison, just as it gradually acquires an increased facility in digesting some alimentary substances which are at first indigestible" (p. 29). This may be the case in part; but something is probably, also, owing to a gradually diminishing susceptibility of the impression produced by narcotics in the organic nerves, and of the nervous system generally, owing to their frequent exhibition.

59. (*g*) The *moral and physical states* of the system also modify the operation of poisons, especially of organic poisons, narcotics especially. Great mental excitement, anger, passion, &c., delay, or, to a certain extent, counteract the operation of narcotic and sedative substances, while the depressing passions hasten and ensure their effects. Several diseases, especially those of the nervous systems, as tetanus, rabies, mania, hysteria, &c., admit of large doses of opium, or of other narcotics, being given without injurious effects. Other substances, however, which are more sedative than narcotic, as tobacco, colchicum, prussic acid, &c., and which act more upon the heart, are not tolerated so manifestly during these diseases. Febrile diseases, especially during the stage of excitement and increased vascular action, delay or counteract in some degree the action of some poisons; while the same maladies, and more especially pestilential fevers and pestilential cholera, particularly during the stage of exhaustion, show that the frame is more or less insusceptible of the impression usually made by poisons. This want of susceptibility is owing to the low or exhausted state of vital function throughout the body, and to the absence of those vital conditions, or the commencing departure of these conditions, by means of which agents act upon living bodies.

60. Other diseases, or a predisposition to them, as to apoplexy, palsy, or congestive states of the brain, diseases of the heart, inflammatory states of the stomach or intestines, congestions of the liver, &c., may severally favour the operation of certain poisons, while these latter may excite or determine an attack of these maladies. Where there is an apoplectic or paralytic tendency, a small dose of a narcotic may occasion a serious effect, or even produce a seizure; and, when there is serious organic change in the heart, a large dose of a sedative, as of hydrocyanic acid, colchicum, or even a moderate dose, may terminate life. The irritant poison, which may be innocuous in some instances, may be fatal in others, where disease of the stomach or bowels, or a tendency to it, already exists; but this subject requires no farther illustration. It should also be kept in recollection that bloodletting, either soon after or before a poison has been taken, accelerates the action of such poison, if it remain in the part, by promoting its absorption.

61. VII. Circumstances which should suggest Suspicions of being poisoned.—(*a*) *The sudden appearance of severe symptoms while the patient is in health.* It is comparatively rare that a substance can be taken in an injurious quantity without almost immediately producing serious ailment. Without denying the occasional production of slow poisoning by the practiced poisoners of the Middle Ages, and of the succeeding two or three centuries, it may be admitted that this mode of poisoning was not so frequently attempted or accomplished as is generally supposed. At the same time, it should not be overlooked that poisons may be administered, as they sometimes have been, during the *illness* or the *intoxication* of the poisoned person, in order that the act may appear as the result of these states. The poison may even be added to the patient's medicine, or substituted for it, as has been shown on several occasions. Generally, the symptoms of being poisoned appear either immediately, or within an hour after the poison has been taken; and

it very rarely occurs that they are deferred beyond two hours, or three hours at the farthest. There are occasions, however, in which slow poisoning may occur unintentionally, and the symptoms be gradually and very slowly developed. I have met with several instances, in a somewhat long course of practice, of active and cumulative medicines having been given in large or frequent doses for so long a time as to produce dangerous, and even fatal effects; these effects having been mistaken, owing to the ignorance of the practitioner, for the progress and issue of the natural disease. Colchicum, digitalis, tobacco injections, opiate injections, tartar emetic, the preparations of iodine, and several other substances, have thus produced effects for which they did not receive the credit.

62. (*b*) *The appearance of severe symptoms after a meal, or after taking any substance, fluid or consistent, into the stomach, or after any substance has otherwise been exhibited or applied, should also be a source of strong suspicion.* What I have said above (§ 2–11), as to the several modes of poisoning, is sufficient to show that poisoning may be produced in various ways, besides the usual way of mixing the poison in the food or drink of the poisoned person. When, therefore, violent or fatal symptoms occur suddenly, or proceed rapidly, diligent inquiry should be made as to the time, nature, and kind of the patient's last meal, as to the circumstances and occurrences to which he has been exposed, as to the persons with whom he last had communications, and as to his habits and morbid tendencies. It should be kept in recollection that disease may exist, even for a long time, without occasioning suffering so great as to prevent his usual avocations; and that the stomach itself even may be the seat of disease, and yet a full meal may be taken, after which the most violent symptoms may supervene suddenly and carry off the patient. This is not an infrequent occurrence in cases of perforation of the stomach met with in practice, especially in young women (*see* Stomach, *Diseases of*). A fatal result, presenting the symptoms of poisoning, may also follow the ingurgitation of a large meal, or of indigestible substances, after long fasting, or of cold fluids when exhausted.

63. When several persons have partaken of the same meal, or of the same substances, as the individual who has been attacked with severe illness, the circumstance of the greater or less disorder of all, according as a particular article was partaken of, or the escape of any or of all, with reference to the meal generally, or to any particular article which it comprised, should receive due consideration; for, when all, or several of those who have partaken of the same meal, suffer more or less, the suspicion of poison amounts almost to proof, while the illness of one merely, others who had partaken of the same article not being affected, is a presumptive indication of the disorder being owing to other causes. In estimating, however, matters of this kind, the liquors and fluids drank, and the congruous nature of these, the one with the other, and with the several articles of diet also partaken of, should be taken into the account. Although it may be inferred that all who partake of the same poisoned dish will suffer according to the quantity partaken of, yet such is not always the case; for the poison may be unequally mixed in the food; and, as respects certain poisons, especially those most frequently employed in this manner, as arsenic, a larger quantity of the poison may prove more innocuous than the smaller quantity; for the former may be vomited, while the latter may be retained and act most violently.

64. It ought to be recollected that various articles of diet may produce symptoms which may be more or less severe in all who have partaken of either of these articles, and these symptoms may depend upon the nature of the article itself, and not upon the admixture of any poison. Nevertheless, the article of diet is poisonous; but there is generally in this case no criminal poisoning; for the state and probable effects of the article are generally unknown, and not suspected by any one until the effects appear. Rancid bacon; unclean or improperly-fed fresh pork; dried or ill-cured meats and sausages; various kinds of fish, whether diseased or imperfectly cured, or kept too long; [cheese]; the flesh of diseased or over-driven animals; several kinds of shell-fish, [as oysters and muscles], especially when out of season; tainted or fly-blown meats, &c., are often productive of irritating and depressing, or acro-sedative effects, and have suggested the arrangement of these articles in the class of poisons which act in this manner.

65. (*c*) *The state of the patient's spirits or feelings previously to his seizure, and other matters which circumstances may suggest, should receive attention.* Acute observation and inquiry, exercised with due discretion and proper feeling by the physician, will often throw considerable light upon the origin and the agent of poisoning; will indicate either the accidental, the suicidal, or criminal nature of the act. The acumen required in such circumstances as present themselves in connexion with poisoning cannot be aided by what I can say on the topic; it will generally be sufficiently exercised by the well-educated practitioner of the present day; but the following should be more particularly observed, in all their relations, as upon them depend not only the recognition of the poisonous substance, but the treatment and life of the poisoned person, and the discovery and punishment of the guilty.*

66. Matters requiring the Attention of the Physician when Suspicions of Poisoning are excited.—When severe illness occurs in the circumstances just noticed, endeavours should be used to ascertain every particular as to circumstances and manner of its appearance. The vessel, utensil, or bottle, or paper which contained the injurious or suspected article; the remains of such article, whatever it may be, and of the food or drink which had more recently been taken; the matters thrown off the stomach, and the substances on which the sus-

[* During the prevalence of malignant cholera in 1832, we mistook a case of poisoning by arsenic for an attack of this disease. A lady took more than a drachm of the arseniate of potash, as we afterward ascertained, with the intention of destroying her life; which was followed by severe retching, vomiting, cramps, lividity of skin, cold and clammy state of the surface, and the other symptoms which usually attended a severe attack of cholera. During the prevalence of this disease much greater caution will be necessary on the part of the practitioner, or he will be liable to err in diagnosis. The symptoms which attend a violent attack of cholera scarcely differ from those caused by the irritant class of poisons.]

pected article has been spilt or rejected, should be carefully examined, in order to ascertain the nature of the poison; and, in cases of criminal poisoning, they ought to be preserved and chemically investigated, as fully set forth in works on *Medical Jurisprudence*. If death take place, the examination of the body as to position and external appearances should be minute; and the contents of the alimentary canal, and of the urinary bladder, as well as the digestive organs, and, in some instances, other organs also, should be carefully investigated, both anatomically and chemically, in order to ascertain the actual presence of the poison and the amount of structural change produced by it. Numerous other matters connected with the poisoned person, and with the appearances of the various objects around him, both before and after death, ought to be noted; but, as these have especial reference to judicial proceedings, I must refer the reader to medico-legal works, especially to what has been stated by Mr. Taylor in his "*Medical Jurisprudence*."

67. VIII. The Symptoms caused by Poisons cannot be duly considered until I treat of the operation of individual poisons. I may, however, remark, that the symptoms usually assigned to many poisons have not been observed with accuracy nor described with due precision; and that they do not in many cases admit of either accuracy or precision, as they vary with the dose of the poison, and with the circumstances shown above (§ 51, *et seq.*) to modify them more or less. It will be seen from the *arrangement* I have adopted in discussing the action of particular poisons, that I have attempted to take a more intimate view of the effects produced by them than has usually been taken, and to base upon these effects a classification which may aid not only the recognition of the injurious agent, but also the adoption of appropriate means for the removal of these effects. It must have been manifest to all who have observed the operation of poisons, that many acrid or irritant poisons do not produce nearly the same nor similar symptoms; that several substances which have been arranged as acro-narcotic poisons produce no narcotic effects, unless contingently; that vitally depressing agents have been classed with pure narcotics, the effects resembling narcotism sometimes observed being merely those of departing cerebral functions, and that the effects which have been imputed to local irritation only have been quite as much owing to change of function throughout the economy, or to extreme vital depression. M. Orfila, who has devoted himself so ably and remarkably to the subject now before me, and has performed so many experiments with poisons on the lower animals, has certainly reduced the classes of poisons to a too limited number, and has erred in considering many of the symptoms, as well as of the lesions after death, to have been caused by the poisons experimented with, instead of viewing them as partly the results of the injury inflicted on the animals the subject of experiment. Other experimenters no less deserve the same imputation. When he as well as they inform us that certain poisons were given to dogs, that, in order to prevent their rejection by vomiting, the œsophagus was tied, and that, in addition to various lesions thereby produced, the lungs were found congested or inflamed, can we be warranted in assigning the pulmonary lesion to the poison only? Is not some part of these or of other lesions observed owing to the injury inflicted by the operation or by the ligature on the nerves in the vicinity, or on those actuating the œsophagus or adjoining parts?

68. i. The more intimately and accurately the symptoms of poisons are observed, the more easily will they be distinguished from natural diseases; and it is of the utmost importance that the former should not be mistaken for the latter. The distinctions will be noticed in the sequel; but I may here state, that the features of *gastritis, enteritis, gastro-enteritis, peritonitis, bilious and malignant cholera, the several forms of colic, malignant or adynamic dysentery, internal strangulation of the intestines, strangulated hernia, and perforations of the stomach or intestinal canal* may be very closely simulated by poisoning with most of the substances classed under the heads of *acrid and corrosive, acro-sedative, acro-alterative, and septic poisons* (§ 106); the particular features of the assumed disease varying with the particular poison, the quantity taken, and the various circumstances already shown to modify its operation; and that *apoplexy, epilepsy and convulsions, diseases of the brain or spinal marrow, diseases of the heart, rupture of internal viscera or of large vessels, and spontaneous congestion of the lungs* may likewise be simulated by the operation of many of the poisons ranked under the classes *depressing and paralyzing, exciting and exhausting, narcotic or stupefying, and narcotico-acrid*, the particular or special effect varying according to the circumstances just alluded to.

69. From this it will readily appear that the difficulty of inferring, with any degree of accuracy, the particular poison which has been taken, from its effects only, is extremely great; and hence the necessity of obtaining farther information as to its nature from what may remain of the vehicle in which it has been taken or otherwise employed, from the matters vomited or evacuated by the bowels, and from other sources or circumstances. In examining the symptoms caused by poisons, care should be taken to estimate as accurately as possible the remaining vital and nervous energy of the patient, to ascertain by the hand and by the ear, or stethoscope, the impulse and energy of the contractions of the heart, to observe the manner in which position affects the state and feelings of the patient, as well as the pulse, and to distinguish between effects which are truly narcotic and those which are still more serious, viz., those proceeding from extremely depressed or departing vital manifestation of the brain. Equal care should be exerted not to mistake increased irritability for excitement or augmented power, and not to confound a very rapid or a very open and compressible pulse with consecutive inflammation, although inflammation may be actually induced, but it is of an asthenic or spreading kind when it thus appears; for these states of the pulse may arise merely from some degree of remaining irritation, from the alterations produced in the blood, or even from a portion of the poison still irritating the organic nerves and vascular system. In fine, care should be taken not to mis-

take the constitutional commotion consequent upon vital shock and exhaustion for sthenic or increased vascular action; and not thus be induced to deplete and lower the system, when we should calm its agitations and support its powers.

70. ii. The Duration of Poisoning necessarily varies with the virulence of the poison, with the quantity taken, and the repetition and frequency of the dose, and with the circumstances stated above as modifying the operation of poisons (§ 51, *et seq.*). Owing to these and a variety of other causes, appertaining either to the nature of the poison or to the state of the poisoned person, and to the effects more immediately resulting from a combination of these, poisoning may be, 1st, *acute or rapid;* 2d, *chronic or slow.*

71. *A. Acuteness* or *rapidity* of action is usually the result of the virulence and quantity of the poison; but, owing to the greatness of the quantity, the poison may be rejected by the stomach, and the expected result may either fail, or be more slowly produced. The state of the stomach, especially as respects the contents of the viscus, may also cause a similar issue, by absorbing much of the poison, and protecting the stomach from it.

72. *B. Chronic* or *slow poisoning* may result, 1st. From the lesion caused by a large dose of an active or virulent poison, which, although insufficient of itself to produce immediate or rapid death, owing to the above or other causes, is still sufficient to occasion changes leading, more or less directly and manifestly, to a fatal issue, *acute* thus subsiding into *chronic* poisoning; 2d. From the nature and quantity of the substance, which had been given in such a dose at first as to produce a slow but fatal effect; 3d. From the repeated ingestion of small quantities, which have gradually developed structural changes, or which, by their cumulative and latent influence, have ultimately burst forth into active operation. Illustrations of these several manifestations of the effects of poisons will appear in the sequel. Of the writers who have discussed the action, the effects, and the treatment of poisons, none has so judiciously marked the distinction between *acute* and *chronic poisoning* as Dr. Pereira, in his very distinguished work on the *Materia Medica.*

73. IX. The General Diagnosis of Poisoning.—The diagnosis of poisoning in the *living* and *dead body* is *general* and *special.* The *former* I shall briefly advert to; the *special diagnosis of poisons, or of poisoning*, requires a recourse to the most precise analysis, to chemical manipulations and chemical tests, and falls not within the scope of my undertaking.—i. *The general diagnosis of poisoning during life* has been partly considered in the preceding sections (§ 28–72), and it is more fully exhibited in the description of the several poisons about to be noticed; but farther evidence is to be obtained from the presence of poison in, or the absence of it from, the articles or fluids partaken of by the patient, and from the matters vomited by him. When poison is found in the matters vomited in the presence of a medical or scientific man, the proof of poisoning is much stronger than when it is found in the remnants of food partaken of; inasmuch as it is evident from this that the poison has actually been taken; whereas, in the latter case, it may have been put into the food with some sinister purpose, and not have been swallowed at all. Mr. Taylor justly remarks, that it should be recollected, while investigating a case of poisoning in the living subject, that this act is sometimes *feigned*, and at others *imputed.* It is very easy for an evil-intentioned person to put poison in food and to accuse another of having administered it, and to introduce poison into the matters, either vomited or discharged from the bowels. The detection of poison in the matters thrown off the stomach affords no decisive proof that it has been swallowed, except under two circumstances: 1st. When the accuser actually labours under the usual symptoms of poisoning; in which case there can be no feigning. 2d. When the matters are undoubtedly vomited into a clean vessel, in the presence of the medical man, or of some person on whose testimony perfect reliance may be placed; these matters never having passed from his view, from the moment of their rejection from the stomach until their analysis, examination, or due custody, under proper seals.

74. *A. The time at which death occurs after the first symptoms of poisoning* is of importance, inasmuch as death from natural causes rarely occurs in so short a time as from poisoning. Having ascertained all the circumstances connected with the attack, and all the symptoms manifested from the moment of attack until death, the exact time which has elapsed from the former period until the latter should be correctly estimated, as one of the elements for the formation of an accurate opinion as to the existence or non-existence of poisoning, and even as to the particular cause or agent of it. When a poison has been given in large quantity, the result may be supposed most likely to occur in the shortest time in which it is usually found to act. But the circumstances pointed out above (§ 52, *et seq.*) may delay its action or its ultimate effects. Poisons not only differ from each other in the period they take to produce a fatal result, but the same poison differs remarkably in this respect in different persons, although the several circumstances, as far as they may be known, appear to be nearly the same. Hence it is difficult to determine the shortest period in which a given poison will destroy human life, when swallowed in large quantity; and little reliance can be placed upon the circumstance of an imputed death from a certain poison having occurred too rapidly or too slowly, as a proof of its not having been taken; for an empty state of the stomach, the retention of the poison, and an exhausted state of the poisoned person will accelerate, and a full stomach and free vomiting will delay, the fatal result. On this subject Mr. Taylor states, that a large dose of strong *prussic acid, i. e.*, from half an ounce to an ounce, will destroy life in from ten to twenty minutes. In one case of this kind of poisoning, the particulars of which I had occasion to investigate, death must have taken place in about five or six minutes. If the person who is poisoned by this acid survive an hour, or even less, there are hopes of his recovery. *Oxalic acid* may prove fatal, in the dose of from half an ounce to one or two ounces, in a period varying from ten minutes to an

hour; and if the poison be not dissolved when swallowed, the period may be very much longer. The *strong mineral acids* destroy life, in large doses, in from twelve or sixteen hours to twenty-four hours. *Arsenious acid* usually is fatal, in periods varying from twelve hours to two or three days; but it may cause death in much shorter periods—in one, two, three, or four hours—an hour being about the shortest time. Mr. Taylor, however, remarks, that there is nothing to prevent arsenic from destroying life in one hour; and that, in a case which was most probably one of poisoning by arsenic, death took place in half an hour. The shortest time in which *opium* has been said to destroy life is three hours; but the period usually varies from six to twelve hours; but with it, as with all other poisons, the fatal issue may be protracted long beyond the limits mentioned of the more common period.

75. While the rapidity with which death from poison may take place is duly recognised by both professional and other persons, the fact that the same or other poisonous substances may occasion death slowly as well as suddenly, and even as slowly as the most chronic diseases, has not been sufficiently regarded, and the evidences connected with these effects have not been sufficiently, even if at all, investigated. There can be no doubt —and several instances of the fact have come under my own observation in the course of practice—of powerful medicines—of poisonous substances—having been too frequently or too long prescribed, in what was then considered full medicinal doses, now more justly estimated as dangerous quantities, and the consequences have been attributed to the progress of disease, to idiosyncrasy, or to other causes than the real. To those slow or chronic operations of poisons I shall advert when treating of individual poisons. It should not, however, be overlooked that disease of the heart and apoplexy may produce death as suddenly as a most virulent poison; and sometimes even more suddenly than any poison, with the exception of hydrocyanic acid. Death may occur almost instantly from organic disease of the heart, and but rarely within an hour from apoplexy, this acid being, perhaps, the only substance, unless in the very rare instances above noticed, which occasions death in so short a time; but, unless it be employed to commit murder, some traces of this poison are usually found at hand.

76. *B.* It may so happen that the *duration* of the symptoms is the only or the chief medical diagnosis of poisoning. In this case there must be both difficulty and uncertainty; and an opinion should not be formed without farther aids, although a careful review of all the known circumstances of the case, and of all the appearances about the person poisoned, may lead to very probable, and even correct inferences. In *acute poisoning*, or when life is rapidly destroyed, the diagnosis is generally more easy than in the *chronic*, or when death is occasioned by the consecutive effects of poison. But in many, even of the chronic cases, the cause of death is more or less manifest; as when a person who has swallowed a mineral acid, only partially recovers, and continues for many months afterward to complain of stricture of the œsophagus, of which he ultimately dies. More frequently, however, it is most difficult to assign, with legal strictness, the ultimate result to the primary agent; to connect the fatal issue with the changes first produced by the poison, in cases of chronic poisoning; for numerous fortuitous influences or contingent agents may have intervened to re-enforce, modify, aggravate, or otherwise affect the earlier alterations, and thereby to subvert the regular succession of morbid phenomena from the first impression of the efficient cause until the fatal issue.

77. It is chiefly in a medical and strictly practical point of view that the slow effects of poisons—that *chronic and slow poisoning*—becomes interesting, and even most important: a form of poisoning altogether neglected by medical jurists, because rarely admitting of proof which may not be impugned. Corrosive sublimate, iodine, the arsenical solution, strychnine, digitalis, colchicum, and many other substances may severally be given in doses so large, or for so long a time, either with a beneficial or with a criminal intention, as to destroy life after a more or less prolonged period. In these cases the slow operation of the poison may occasion symptoms which may not be recognised as the effects of the medicine; or little or no effect may appear for a considerable period, until it suddenly breaks forth with such violence as to threaten, or even suddenly to destroy, the life of the person to whom the substance has been thus administered. But the effects may be both marked and characteristic of the poisonous substance prescribed, and yet be viewed as a part of the disease, and even identified with the disease which it was employed to remove. I hope, however, to direct a more especial attention to this matter in the sequel than it has hitherto received.

78. ii. *The diagnosis of poisoning furnished by post-mortem appearances* has been very ably considered by the recent writers on medical jurisprudence. Mr. Taylor, whose accuracy is generally commendable, remarks, that "in relation to external appearances there are none indicative of poisoning upon which we can safely rely. It was formerly supposed that the bodies of persons who were poisoned putrefied more rapidly than those of others who had died of natural disease; and evidence for or against poisoning was at one time drawn from the external appearance of the body. This is now known to be an error; the bodies of persons poisoned are not more rapidly decomposed, *cæteris paribus*, than those who have died a sudden or violent death from any other cause whatever." (P. 42.) To the above too general and positive inference the following exceptions may be made: 1st. That external marks or changes may be left on parts of the external surface, as the mouth, face, neck, hands, and near the outlets of the natural canals, which not only may indicate poisoning, but even the particular substance employed, as several of the corrosive and irritant poisons. 2d. I have had proofs furnished to more than one of the senses —namely, to sight, smell, taste, and touch— that certain poisons, which I have classed under the head *septic and disorganizing*, actually produce a more rapid solution of the vital and physical cohesion of the tissues, or a more rapid progress of those *post-mortem* changes

either preceding or constituting putrefaction, than is usually met with, all the circumstances being otherwise the same. 3d. These senses have furnished me with evidence that certain poisons will sometimes delay these changes, at least in some parts, and even about the outlets of mucous canals.

79. *A.* The several *internal*, and especially the *digestive viscera*, however, are the quarters in which the physician should endeavour to ascertain the fact of poisoning, in defect or in aid of other evidence. The mouth, throat, œsophagus, stomach, and intestinal canal often furnish proofs of it, especially when acrid, corrosive, or irritant poisons have been employed; and although these proofs consist of the most severe lesions, and even of almost complete disorganization, they are often insufficient of themselves to show the particular poison which has been swallowed, or even the action of any poison at all, without proof of its actual presence, or other additional evidence, so completely do these lesions assume, in many instances, the appearances consequent upon certain natural diseases. Much of the difficulty of distinguishing the effects of poison from the consequences of disease is owing to the period which has elapsed from the time of death until that of making the examination; for during that period various *post-mortem* alterations supervene, which obscure certain of the more intimate changes existing at the moment of, or just previously to dissolution. Much of the softening, of the corrosion, or of the dissolution of tissues, found twenty, twenty-four, or thirty-six hours after death, has taken place during that period; and even the changes observed in the colour of the blood and of the several membranes and tissues, have chiefly occurred subsequently to death. In cases where the poison is of a virulent, septic, or of a chemical nature, as the strong mineral acids, or the alkalies, and when these have not been entirely thrown off during the short period of life following their ingestion, it may reasonably be supposed that the portion remaining in contact with the tissues will produce some change of the structures, even after death — will affect the dead textures as we perceive such substances to act in some of the operations of domestic economy, and either hasten or delay the solution of vital or physical cohesion, or otherwise change the appearance and condition of the textures by combining more or less intimately with them. In cases proving thus rapidly fatal, many of the poisons, especially the corrosive, the mineral, or saline, will be found either in the contents of the stomach or bowels, or in contact with the villous membrane of these viscera, or may even be detected by chemical analysis in the coats of the stomach, or even in the liver or in the blood.

80. Death, however, may take place suddenly, and various morbid changes may be detected in the digestive canal, resembling, or even identical with, those produced by certain poisons; but unless the poison be detected in the matters vomited during life, or in the contents of the stomach, or of other parts of the canal, or in the blood, or in the substance of the viscera, the evidence furnished by these changes alone is altogether inconclusive; for similar changes may occur about the time of dissolution in cases of sudden death, or previously, or even subsequently to death, in various diseases not necessarily causing the confinement of the patient until shortly before, or even not until a few hours before death. To these alterations I now more particularly advert.

81. *a. Redness* of the villous membrane of the stomach and intestines is generally caused by acrid, corrosive, or irritant substances; but it is not of itself a sign of poisoning upon which much dependence can be placed, for it may be inconsiderable where corrosion and disorganization, caused by the most corrosive poisons, are the greatest; it usually characterizes all inflammatory diseases of the digestive canal, and it may be very remarkable in cases of sudden death from accident, external injury, or other causes producing fatal shock, and independently of any existing disease, or of the ingestion of any irritating agent, as shown by Dr. Yelloly, and subsequently confirmed by numerous observers. It has been shown, 1st. That vascular congestion of the villous surface of the stomach, with a florid or dark-red hue, is not a proof of disease, and is not inconsistent with a state of health at the time of dissolution or shortly before it. 2d. That this state of redness and congestion, found in some cases after death, is not even proof of gastritis. 3d. That it is not alone an indication of the ingestion of a poison, or even of any irritant. 4th. That the vascularity of the villous membrane is an injection of the venous capillaries and veins, the redness depending, in the instances observed the soonest after death, upon the arterial character of the blood congesting the venous capillaries; and in those observed the latest after dissolution, upon the transudation of the colouring matter, or to the post-mortem changes.

82. *b.* It is obvious that *redness*, as well as *congestion* of the villous membrane of the stomach, is liable to various changes during the time elapsing from death until examination. These changes are not only such as take place in ordinary circumstances during this time, both in the blood itself and in the tissues, but those also which are more especially caused by the morbid impression of the poison by the treatment resorted to, and by the action, previously and subsequent to dissolution, of the poison upon the textures and upon the blood itself. When the redness is caused by poisons which not only irritate, but arrest more or less the putrefactive process, then it may be inferred to continue the longest after death. Mr. Taylor found it continue in the stomach and duodenum of the exhumed body of a man poisoned by arsenic, twenty-eight days after he had been interred.

83. *c. Ulceration* of the internal surface of the stomach is seldom observed in cases of poisoning, and never unless in those which have been manifested by well-marked symptoms previously to death. Ulceration is more frequently caused by arsenic than by any other poison, and this poison may even be found lodged in the edges of the ulcers, which present more generally the appearance of small circular abrasions of the villous membrane, which is more or less generally inflamed, or inflamed in the intervals between the ulcers, the inflammation sometimes extending to the duodenum and intestines. Ulceration from disease is not unusual

(*see* Stomach, *Diseases of*); but in these cases the inflammation surrounds the ulcer, which often has tumefied or thickened margins, while the ulcers produced by poisons present different appearances. The history of the case before death will generally enable the physician to determine to what cause the ulceration should be imputed. But *ulceration* should not be confounded with *corrosion*. Ulceration, although a morbid, is also a vital process, in which the secretions, the nutrition, and the absorption of the part are disordered, consecutively of inflammation. Corrosion is a disorganization of the intimate structure by a chemical action, which destroys the vital properties, and dissolves the vital cohesion of the textures; the corroding substance combining more or less with the tissues upon which it acts. Ulceration requires time to produce it; corrosion takes place instantaneously or almost immediately (see more fully on this subject, Digestive Canal, § 36, *et seq.*).

84. *d. Softening* of the inner surface of the digestive canal is a frequent effect of poisons, and is often found associated with corrosion, but is more diffused. Softening may be often viewed as merely a lesser grade of corrosion, especially when it extends to the several coats. It is generally most remarkable in the stomach, but, when it is limited to this organ, it cannot be considered as a consequence of poisons unless the inference be supported by farther evidence, inasmuch as it is, when thus limited, most commonly the result of disease. When it is caused by poisons, corrosions of some parts often accompany it; and the softening is frequently extended from the fauces down the œsophagus, into the stomach and duodenum. This change should, however, never be considered as a result of poison, unless the poison be detected in matters which have been vomited, or in the contents of the digestive canal, or in the coats of this canal; for it is, even when thus extended, a very frequent result of disease, more especially in infants and children.

[In this connexion, it should be borne in mind that softening of the gastro-intestinal mucous membrane, especially that portion lining the stomach, is very frequently met with in intemperate subjects; indeed, it is the most common pathological change met with in such cases.]

85. *e. Perforation* of the digestive canal is sometimes found, upon dissections, after the ingestion of poison, but it is also not unfrequently a consequence of disease. When caused by poison, it is commonly merely the extension of corrosion through all the coats of the viscus, and is most frequently found in the stomach, but it occurs in rare instances, also, in the duodenum and œsophagus. Perforation, like all other alterations of the digestive canal, although preceded by symptoms of poisoning, is not a proof of this act, unless the other proofs just noticed be also present. When it is a consequence of disease, it is produced by ulceration, which rarely or never occurs in cases of sudden or rapid poisoning, ulceration being the result of a morbid process requiring some time for its production; but this topic will be noticed in the sequel (§ 114), and it is fully discussed in the article Digestive Canal.

86. *f.* The villous coat of the stomach may present other lesions which may furnish stronger evidence of poisoning than any of those already noticed. These are *corrugation, partial detachment, dark discoloration*, resembling *charring*, of the villous membrane; *ecchymosis*, or *small extravasations of dark, coagulated blood*, underneath this membrane, which is raised into small *elevations*, and a *dark-red or livid engorgement of the capillaries* and *veins*. These changes are most frequently found in the stomach; but they are sometimes seen, although in a less marked degree, in the duodenum, and even in other parts of the intestinal canal.* Some degree of *induration* of the villous membrane of the stomach has been found in some cases after poisoning with sulphuric acid.

87. *g.* A *post-mortem* change, which has been variously denominated, and especially as *spontaneous softening, pulpy degeneration*, and *spontaneous perforation* of the coats of the stomach, is met with upon dissection, in rare instances. When this alteration is found in a patient who evinced no indications of gastric disease during life, and when it is unattended by any inflammatory appearances, the coats being gelatinous or pulpy, it may then be viewed as a consequence of the action of the gastric juices after death, as first stated by John Hunter, and rendered probable by the more recent researches of Carswell, Burns, Sharpey, and others. But a nearly similar change may be the result either of poisons or of disease. In the former case, which will be more particularly noticed hereafter, evidence of poison will generally be found either in the organ itself, in its contents, or in the matters vomited; and, in the latter, gastric disorder will have been manifested previously to dissolution, and the pulpy softening or perforation will be accompanied with some indications of inflammatory irritation, although in the aphthous, mesenteric gastric, and gastro-enteric diseases of children, and more especially of infants, about the period of teething, weaning, and, when improperly fed, softening, and even perforation of the stomach will occasionally be found, inflammatory appearances either not existing, or, if they have existed, having altogether disappeared soon after death (*see* Digestive Canal, § 35, 42).

88. iii. The other *means of diagnosis*, so frequently adverted to above, namely, *the detection of the poison by chemical analysis and tests*, and the support which *moral circumstances* may afford the evidence, belong more especially to the medical jurist.—*A.* The *moral circumstances and appearances*, falling under the observation of the physician, should always be carefully remarked by him, not only as they may suggest to him the existence of poisoning, and thereby direct his attention to every point and aspect of the case, but also as they may be required from him in the judicial investigation, in which he will appear as a principal evidence. In every instance admitting of the least suspicion of poisoning, it is the duty of the medical man to ascertain as fully as in his power the whole range of symptoms or morbid phenomena; to observe assiduously the progress of the symptoms, from the moment they came under his notice until their termination in recovery or in death; to obtain information from those best

[* All these appearances result from the habitual use of distilled liquors, and when met with, the habits of the individual should be closely investigated.]

able to furnish it, as to the circumstances connected with the origin and progress of the seizure; to trace their origin in obvious or imputed causes; to connect them, as far as may be done, with such causes as usually produce similar effects, and to determine, as far as possible, the presence of such causes in the case in question; and, if death take place, to note carefully all the changes observed in the dead body.

89. The importance of care and circumspection in these matters is shown by the fact that, although instances often occur in which the diagnosis of poisoning cannot be established, unless the poison be actually detected, to the satisfaction of the tribunals, still it may be sufficiently so to warrant the physician in the adoption of such measures as the symptoms will suggest for the recovery of the patient. And it should be recollected that, even in the event of death, there are many poisons which, owing to their nature, cannot be detected by any analysis or test, while there are others quite susceptible of analysis, which may be so changed or mixed with substances, alimentary and others, as to escape detection by chemical agents, either in the vomited matters, or in the contents of the viscera, or in the blood. In many such cases, there may be satisfactory proof of the persons having been poisoned, and, in some, conviction has actually followed, although the poison has not been detected in the dead body; the symptoms, the appearances after death, and the moral circumstances being sufficient to establish the fact. Moreover, due attention to every circumstance connected with the history and progress of the case, as insisted on above (§ 61–72), will enable the physician to ascertain, even during the life of the patient, the particular poison employed, or, in default of this, the class of poisons to which it belongs, and to adopt a plan of treatment, which, if not successful, may nevertheless be appropriate to the symptoms and circumstances of the case. In the event of death, also, he will be more surely directed in his search for the substance which caused it, and his analysis and tests will be chiefly suggested and guided by the changes which the *post-mortem* examination will disclose.

90. *B.* As soon as suspicions of poisoning are excited, or indications of it evinced, the *portions of the substance* which has produced the symptoms should be sought for on the persons of the poisoned and of the suspected individual; and if the substance cannot be found in the pure state, or in that of mixture with other substances, a chemical analysis should be instituted of the *several articles, fluid and consistent, of which the patient last partook;* and this inquiry should be full and satisfactory; for one portion of a dish may be poisoned, and not the other; the gravy, and not the meat; the sauce, and not the fish; the pie-crust, and not the fruit, &c., &c. The salt may contain arsenic, and nothing else at table may contain this poison; and so on as respects various articles, and as regards several poisons. *The matters vomited*, and those *evacuated* from the bowels, the former especially, should be chemically examined, or tested, as soon as possible, and during the life of the patient, whenever there is doubt as to the nature of the poison, in order that the treatment may be as appropriate as possible; but as tests, and a chemical laboratory, cannot be carried about with the physician, the physical appearances and characters of the matters thrown up should be carefully observed, in connexion with the history of the case, and the existing symptoms, and the treatment directed accordingly. The vomited and evacuated matters ought, however, to be carefully preserved for chemical analysis, and those thrown off the stomach should be compared with *the matters found in the stomach and intestines after death.* These matters, with the digestive canal itself, and often with the collatitious and other viscera, should then be made the objects of chemical research, in order to satisfy the ends of justice. But this subject does not fall within the scope of this work.

91. X. Diagnosis of Poisoning during Disease.—This is a topic which has been slightly adverted to above (§ 59, 60) as one which has received but little attention from medical writers, and which hardly admits of satisfactory elucidation.—(*a*) *Poisoning, either criminal, accidental, or suicidal, while the poisoned person is the subject of disease, or under medical treatment*, has occurred oftener than has been commonly suspected. Poisoning in these circumstances has certainly been attempted, and even accomplished, much more frequently than it has been detected, owing, 1st. To the difficulty of determining the symptoms during life, and the changes after death, which belong respectively to disease and to poison; 2d. To the facility with which a poisonous substance may be added to, or substituted for, the patient's medicine, without suspicion being excited; 3d. To the symptoms caused by the poison being mistaken for the severity and progress of the disease; the previous duration of illness and other circumstances preventing any inquiry as to the cause of death; and, 4th. To the circumstance of the poison which has been employed not admitting of chemical detection, either from its nature, or from the state of admixture or combination in which it has been taken. The difficulties in forming a correct diagnosis when a person is poisoned, in the course of disease, is heightened by the acuteness and severity of the malady; and when a poison has been administered whose operation is such as closely to resemble, or as to appear, an aggravation of the symptoms of which the patient had complained, then the diagnosis can hardly be established, unless by the detection of poison in the matters vomited or in the evacuations from the bowels or kidneys, or in the body after death.

92. (*b*) When a patient is suffering from diseases of *debility*, or is labouring under *exhaustion, anæmia*, the effects of *losses of blood*, and *chronic discharges*, poisoning is more readily effected, especially by depressing, paralyzing, and acro-sedative substances, than in other circumstances; and the effects, especially when the poison has been administered in successive doses, or at intervals, are not readily recognised or distinguished from the progress of the malady. In these states, also, of the patient's health, more especially when hæmorrhage or vascular depletions have preceded the ingestion of poison, absorption of it into the circulation more readily and more injuriously takes place, and the patient furnishes much less of vital resistance to its fatal operation.

93. (*c*) I have had several reasons to believe, from the history of cases, &c., that poisoning has been both attempted and accomplished in the *puerperal states*, especially during the first two or three weeks after delivery; the operation of the poison having been mistaken for one or other of the diseases incidental to that state; and having been such as not to be distinguished from such disease unless by the discovery of the poison, aided by various moral considerations.

94. (*d*) *Acute diseases of the digestive canal and associated organs* may have existed for a longer or shorter time, and irritant, acro-sedative, or corrosive substances may be administered accidentally, criminally, or from ignorance, which may so aggravate the attack as to render it dangerous or fatal. The heroic practice of medicine, so general and so much lauded, even within the range of my own observation and recollection, by those who concealed their ignorance by the swaggering boast of being "practical men," and that the literature and science of medicine were beneath their notice, as they were certainly beyond their reach, has furnished me with several proofs of actual poisoning having been committed by those self-sufficient and illiberal medicasters in the treatment of the diseases just mentioned. I have often seen, and had still more frequent occasion to remark, in medical writings, the recommendation of the most irritant purgatives, in excessive doses, in cases of enteritis, or in dysentery, with the intention of removing obstructions, or of expelling matters which had no existence, the substances prescribed either causing inflammation, or increasing that which already existed, and urging it on to a fatal issue. Irritant, corrosive, acro-sedative, or acro-narcotic substances, given either in poisonous quantities, or in so frequent doses as to become poisonous, in the course of these maladies, could not readily be recognised by their effects in these circumstances, nor even by chemical research, if the employment of them were concealed, and the mischievous tendency of their operation were not known.

95. (*e*) Even in *chronic diseases* of the alimentary canal, especially *chronic dysentery*, or the *chronic diarrhœa* of warm climates, the exhibition of repeated doses of acrid purgatives, or of other medicines, with erroneous views of the nature of the case, and of the operation of the substance prescribed, has converted a complaint by no means serious into one which has become rapidly fatal. I have seen this practice in various places, and I could adduce numerous cases in which it has been recorded in published works, or in the case-books of hospitals, furnishing useful, although fatal, beacons in navigating the shoals of medical practice.

96. (*f*) Persons already the subjects of *diseases of the heart* or *of the lungs* may be cut off by a criminal, or an incautious use of various sedative, acro-sedative, or acro-narcotic substances, especially when taken in too frequent doses, or continued for too long a time. Digitalis, tartar-emetic, colchicum, aconite, &c., may be given in these diseases so as to produce a fatal result, without the symptoms being suspected as being caused by poison, or the result being viewed otherwise than as the *natural termination of the disease*; and the examination of the body after death, and chemical research, will fail of discovering the cause. From 1810 until 1830—a period abounding with medical cant, heroic and empirical practice, and disgusting dogmatism—certain substances came into very general use, from the abuse of which much mischief accrued, even within the sphere of my own observation; calomel, tartar-emetic, colchicum, digitalis, and, more recently, iodine, were often given in such excessive doses, or continued in smaller quantities for so long a time, as to induce more serious diseases than those for the cure of which they were resorted to. The natural maladies had the efforts of nature to aid them, if these efforts had been developed or duly directed; but the substances which were employed subverted vital energy, suppressed the natural efforts, produced morbid actions and organic lesions, which were mistaken for the course or turn of the primary malady; and, when they failed of causing death, occasioned a new or different form of disease. A patient had disease of the valves of the heart and dropsical effusion; large doses of infusion of digitalis were prescribed to act as a diuretic, and this effect was sometimes produced, and a certain amount of ease resulted; but quite as frequently the disease was arrested in a different way; the action of the heart was so much weakened by this treatment as to become insufficient to overcome the obstacle to the circulation, and death was the consequence. Early in the present century, colchicum and tartar-emetic were lauded as antiphlogistic remedies, as they certainly are, and were often brought in aid of the copious blood-lettings and various other empirical means unduly lauded by the ignorant pretenders and writers of the day. More than one writer of great but ephemeral popularity extolled these substances, and prescribed them in excessive doses for the inflammatory and other diseases of the lungs and bronchi, both of children and adults; and I am confident that, in the former class of patients more especially, they were employed in such quantities, and for so long a time, as to prove fatal to more than they cured. The vital resistance, which so successfully opposes the progress of disease in most instances where there is no constitutional vice, was completely overthrown by these and similar means; and while vitality was either suppressed, impaired, or altogether destroyed by them, no opposition could be furnished to the unfavourable progress and consequences of the disease.

97. This subject might be pursued with reference to the diseases of other organs, and to various constitutional and febrile maladies; but I have, perhaps, stated what may be more than sufficient to rouse the attention of those who are not sufficiently aware of the importance which ought to be attached to it; well-educated, closely observing, and, in virtue of these, the only experienced practitioners, hardly require to be reminded of the several matters which these suggestions will undoubtedly recall to their recollection. Any further notice which this subject may require, will be taken of it in the discussion of the effects and treatment of individual poisons.

98. XI. The General Principles of Treatment.—What I have advanced will show the importance which should be attached to the

operation of poisons, as forming the basis of rational measures of prevention and cure. Before I proceed to notice the injurious operation of particular poisons, and the treatment which each appears to require, I shall first offer a few remarks upon certain intentions and principles of treatment, which are more or less generally applicable, according to the mode of poisoning which has been resorted to. These brief remarks will refer to the *prevention*, to *the counteraction*, and to *the removal of the effects of poisons*.

99. *A. Prevention of the action of poisons* may be attempted in certain circumstances, and may succeed either partially or completely. A poison may be swallowed, and, if the means be immediately resorted to, it may be removed before it has acted, or acted to a very injurious extent. —(*a*) The means of removal are *emetics* and the *stomach-pump*. Of the former, but little may be said more than that they often fail to act, owing to the paralysis, or want of power of contracting, experienced by the parts concerned in the act of vomiting from the action of the poison which has been swallowed. It is, therefore, requisite to give powerful and warm emetics, as the sulphate of zinc, with capsicum, mustard, &c., according to the nature of the poison which has been taken; the intention being to excite the organic nervous influence at the same time that the discharge of the poison is procured, when this latter is of a sedative or narcotic kind.

100. (*b*) The removal of the contents of the stomach by means of an apparatus, such as that now in general use under the name of *stomach-pump*, although suggested by several persons long before the practicability of such means was actually put to the test, was first demonstrated, as being efficacious in cases of poisoning, by Messrs. Jukes and Scott in 1822, then medical practitioners in Westminster; and, in many instances, it is the most efficient and certain mode of removing the poison; but it is liable to certain objections. The perforations in the end of the tube may be obstructed, or the canal of the tube choked by the alimentary substances present in the stomach, and the withdrawal of the contents and of the poison will be thus delayed or even prevented, if fluids be not injected into the stomach by this tube, in order to remove the obstruction and dilute the contents of the viscus. In cases, therefore, in which imperfectly dissolved poisons have been taken, or where a greater activity may be imparted to the poison by dilution or solution, the recourse to injections may be injurious, and the use of this apparatus may be less efficacious, in these circumstances, than an active emetic, which often empties not only the stomach, but the duodenum also, and increases the secretions of the villous surface and of the liver, thereby washing off the adhering portions of the poison, or preventing the imbibition and absorption of them. When, however, a judiciously-prescribed emetic fails to act, or in cases in which an emetic may be inferred to be inactive, or in other doubtful circumstances, recourse to the stomach-pump should not be a moment delayed.

101. The removal of the poison is an indication which is not confined to cases in which the substance has been swallowed. It is equally important in instances of *external poisoning*, the object being the prevention of the imbibition and absorption of the poison. There are two modes by which this intention may be accomplished: 1st. The application of a ligature above the part which has been inoculated with the poison, or between it and the trunk, so as to arrest its absorption and contaminating influence, and the diffusion of its impression by means of the nerves. This mode of prevention has been in use from the earliest ages, and is practiced by most savage tribes. It is obvious, however, that this practice would be inefficacious if nothing farther were attempted, and that the poison would act as soon as the ligature was removed. The great advantage of the ligature is to delay the operation of the poison until it can be either generally or partially removed by suction, or counteracted by local applications and internal remedies. Many substances are poisonous when applied to the skin denuded of its cuticle, or when inserted in a wound; and may yet come in contact with the mucous surface of the lips and mouth without risk, if there be no abrasion of the epithelium: and hence *suction* of a poisoned wound with the mouth, after the application of a ligature, where this can be applied, or suction without this antecedent in other circumstances, has been resorted to from the earliest ages, and is still practiced in all uncivilized countries. The ligature, by arresting the return of blood, while arterial action increases the capillary injection, and even augments the discharge from the wounded surface, thereby favours the removal of the poison by suction, or by any other mode of exhausting the air over the part which may be adopted.

102. The intention of removing the poison introduced into a wound by exhausting the air over the wounded part was strenuously contended for by the late Sir D. Barry; and for this purpose he advised the application of the *cupping-glasses*; and in situations where a ligature cannot be applied, cupping-glasses are the best means of sucking out the poison, or the blood and serum contaminated by the poison, from the part. But not only is absorption thus prevented, and the poison withdrawn, but the injurious impression made by the substance on the nerves of the part is prevented from extending, owing to the pressure produced by the margins of the glasses. We have certainly not improved in modern times upon the treatment of poisoned wounds recommended by the ancient Greeks, Romans, and Arabians, as Mr. Adams has fully shown. Nicander, Celsus, Dioscorides, Galen, and nearly all the Arabians, advise the application of a ligature, and then the extraction of the poison by sucking, by cupping instruments with scarifications, cauteries, escharotics, &c. They likewise prescribed remedies with the view of altering or counteracting the effects of the poison. If the poison was of a depressing kind or produced cold, they resorted to stimulating and heating medicines; if it was of an opposite nature, they gave refrigerants; but they most frequently had recourse to articles of a heating nature, as they believed that the greatest part of poisons destroyed life by producing cold.

103. *B. The counteraction of the operation of the poison* is the next indication; and it often suc-

ceeds in respect of some, especially if attempted soon after the poison has been swallowed or applied; and the substances which thus counteract the poison have been called the *antidote*, or *counter-poison*. The antidotes of some poisons, especially of some mineral poisons, are well ascertained; and it is chiefly to chemical science that we are indebted for this knowledge; but we know but little of the means of counteracting many other poisons, especially those of the vegetable and animal kingdoms. Those antidotes whose actions have been ascertained are, 1st, those which form chemical combinations with the poison that are not injurious, as alkalies with acids, &c.; and, 2d, those substances which deprive acrid and corrosive poisons of their properties, or which form insoluble compounds with the poison. Certain antidotes are complete and efficient, if administered sufficiently early, or before organic or vital changes of a dangerous nature have been produced; others are only partially efficacious, as ammonia in cases of poisoning with prussic acid.

104. Means which enable the system to resist the action of a poison may be ranked in this category. Those which prevent the absorption of the poison, as several of those which have been already noticed, or such as counteract the depressing influence of certain poisons, as the spices, cayenne pepper, aromatics, spirituous liquors, &c., in cases of animal or fish poisons, are often more or less efficacious. When poisons are taken in large quantities, the economy, especially the nervous system, sustains more or less of shock; and, if appropriate means be immediately used to aid it in rallying, a greater degree of vital resistance will be opposed to the progressive advance of the effects. From these remarks, it may be inferred, that in our endeavours to counteract the operation of a poison, we should attend to the following cautions: 1st. To avoid all means which may render the poison more soluble, or which may dissolve it, or add otherwise to its activity; thus we should not give wine or vinegar soon after a large quantity of opium has been taken. 2d. To avoid such measures as may promote the absorption of the poison into the circulation, as blood-letting. 3d. In cases of poisoning by depressing agents and narcotics, or such as destroy nervous power and irritability, medicines, emetics or others, which act in a somewhat similar manner, as tartar emetic, ipecacuanha, &c., should not be exhibited. 4th. That the shock sustained by the ingestion of virulent poisons should be counteracted by energetic means of a stimulating and restorative kind, administered according to the peculiarities of the case; and that vomitings, however frequent, should not prevent the exhibition of these, in cases of narcotic, depressing, and animal poisons, or even in others, unless the vomitings proceed from the action of corrosive and very acrid poisons.

105. *C. The removal of the progressive effects of the poison, and opposing the tendency to death*, remain to be put in practice either when the first and second intentions cannot be attempted, owing to the time which has elapsed from the exhibition of the poison, or after one or both have failed. To be successful in these circumstances, the physician should be well acquainted with the physiological action of poisons, and with the phenomena by which this action, in its progressive phases, are indicated; with the symptoms and progress of the mischief; and with the pathological states produced by individual poisons, and more immediately inducing death; he should be acquainted with the operation of active substances on the economy, both in medicinal and in poisonous doses, in order that he may duly recognise the nature and effects of the latter doses, and may apply the former to the removal of these effects, according to rational indications. That a knowledge of the physiological and pathological actions conjoined, consequent upon the exhibition of a poison, and of the ultimate changes of which death is the result, is of the utmost importance to the physician, is evinced by the fact that it is this very knowledge which, in extreme cases, and after other indications and means have failed, enables him to devise farther measures which may still be successful. Thus, if it be ascertained that the poison, in the advanced course of its effects, has produced paralysis of the muscles of respiration, or spasm or closure of the glottis, means directed to the continuance of respiration, or the production of artificial respiration, may yet save the patient. This fact has been demonstrated on several occasions, and other analogous illustrations of the principle will appear in the sequel. It is obvious that nothing farther can be advanced with due precision under this head, until the effects of the individual poisons are considered.

106. XII. Classification of Poisons.—The *effects*, and the ultimate *results of poisons* being so diversified and complex—many producing nearly similar or variously modified effects, and the same substance evincing very different phenomena in different persons and circumstances, the effects of a single poison being thus neither constant, nor always distinctly developed—it follows that a satisfactory *classification* of them can hardly be expected. Indeed, all attempts at classification must be conventional; for if we endeavour to arrange them conformably with their physiological action, or according to the systems or tissues on which each appears especially to act, we shall find, as must be manifest from what I have already advanced, that many of them act upon, or through the media of, two or more systems, and upon several functions; and that the substance which affects one person, or one system, in a more or less definite manner, operates differently in others, the effects varying with the circumstances shown to modify the operation of poisons (§ 51, *et seq.*). Although we should have regard to the succession of changes consequent upon the ingestion of a poison until the ultimate results appear, still we have here comparatively little concern with those which follow the employment of the same substance in small or medicinal doses. It is the deleterious action which should be observed, and the best means of counteracting that operation, and of averting or removing its usual effects. The question is not whether or no opium, morphia, or hydrocyanic acid, &c., be stimulants, sedatives, or narcotics, or entitled to other appellations which have been given them; but it is practically, to which of these properties, or to what other property, are the injurious effects chiefly owing, and by what successive changes are these ultimate effects pro-

luced? It is principally the progressing and advanced alterations of vital function or of structural lesion that are to be arrested and remedied, and it becomes most requisite that we should not only know the nature of these changes, their whole extent, and their probable issue, but also that we should arrange those substances which operate in similar or nearly similar modes, and induce similar results, in order that the treatment which may be found successful against one poison belonging to this category may be advantageously extended to the others. That an arrangement of poisons should be adopted according to this principle, with reference to the operation and effects of these agents, and that the classification may thus be made practically useful in a therapeutical point of view, is shown by the extension by the author of the affusion of cold water on the head and neck to cases of poisoning by various narcotic and sedative poisons. The cold affusion had been employed for ages for intoxication and insensibility caused by inebriating liquors; and the author, having repeatedly seen it thus employed with success, had recourse to it in 1821, in a case of poisoning by *opium*, published in 1822 in the *London Medical Repository* (vol. xviii., p. 29), and in 1825 he recommended, in the work now named (vol. xxv., p. 40), this practice in cases of poisoning with *prussic acid*, and with other poisons belonging to the same classes as those just named; and this treatment has been found most efficacious in states of vital depression and insensibility produced by narcotics and sedatives generally. The propriety, therefore, of adopting a classification based upon the most prominent operation and effects of individual poisons, as being the most practically useful, must be apparent. In venturing to recommend an arrangement different from that which has been suggested by Dr. Paris, and from that advised by Foderé, and adopted, with certain modifications, by Orfila, and still further modified by Christison, Devergie, Beck, Taylor, and several other recent writers,* I have been influenced chiefly by the firm conviction, entertained without any doubt from the first enunciation of these classifications, that they were inadequate and inaccurate; inasmuch as the principal operation and effects produced by several virulent poisons had no place given them, or did not fall within the scope of the arrangement, and as various substances were classed under heads to which they could not with due accuracy be assigned, and were hence viewed as productive of effects of which they were altogether innocent, while those which they did actually produce were not at all, or not sufficiently recognised. Thus prussic acid and the prussiates were arranged in the class narcotics, and numerous substances were classed as irritants, whose operation in this respect was the least considerable of the several effects produced by them. From the observations made above as to the *general and special operation of poisons on the animal economy* (§ 28, 34, *et seq.*), the following classification is suggested as corollaries: i. *Acrid and corrosive poisons.* ii. *Depressing and paralyzing, or sedative poisons.* iii. *Exciting and astringing.* iv. *Exciting and exhausting poisons.* v. *Irritating and depressing or paralyzing—acro-sedative poisons.* vi. *Irritating and alterative—acro-alterative poisons.* vii. *Narcotizing or stupefying poisons.* viii. *Narcotizing and irritating—narcotico-acrid poisons.* ix. *Septic or disorganizing poisons—dissolving the vital cohesion of tissues.*

107. As to these classes, I may remark, that the operation of the substances arranged under the *first* is more or less strictly local, when the quantity of either is large, or when the poison is concentrated; but that when certain of these substances are employed in small doses, or in weak solutions, they will then act in such a manner as may warrant the arrangement of them under different heads. The *third* and *fourth classes* might have been comprised in one and divided into *two orders*, but I considered it better to have too many classes than to subdivide them. I may offer the same remark as to the *fifth* and *sixth classes*, but for practical purposes I preferred the arrangement as it stands.

108. XIII. Of the special Effects and Treatment of Poisons—Class I. Acrid and Corrosive Poisons.—*The irritant poisons of several recent authors.* The numerous substances arranged by recent writers as *irritants*, comprise many which I have here denominated and expressed more strictly in accordance with their real operation. It surely cannot be admitted, moreover, that the substances which I am about to consider under this class destroy life by *merely irritating* the surface to which they are applied. Is there no local lesion produced beyond irritation? That the local action amounts to something far beyond irritation will be admitted by every one who is in the habit of observing closely, or of attaching precise meanings to words. The want of precision is here chiefly owing to the circumstance of these writers having classed under the same kind those substances which are most acrid and corrosive, and most limited in their sphere of action, with others which are really but slightly irritant, and which are destructive of life by producing other and very different effects from irritation. This will become more apparent in the sequel.

109. i. Of the Symptoms and Diagnosis of poisoning by acrid and corrosive Substances.—The symptoms vary with the degree of solubility, the concentration of the solution, and with the nature and admixture of the substance. When the poison is very soluble or is fluid, and very corrosive, the mouth and tongue evince most severe symptoms; there are burning and pricking or darting pain, redness, swelling with exudation of lymph, or corrosion and destruc-

* *The arrangement proposed by Professor* Fodere was as follows:

i. Septic poisons. ii. Narcotic or stupefying poisons. iii. Narcotico-acrid. iv. Acrid or rubefacient. v. Corrosive or escharotic. vi. Astringent poisons.

Orfila at first adopted, with slight modifications, the above arrangement, but afterward reduced the classes to the following:

i. Irritants. ii. Narcotics. iii. Narcotico-acrids; and, iv. Septic poisons.

Christison, Beck, and Taylor have adopted this arrangement of M. Orfila, discarding most undeservedly the class septic poisons.

The classification suggested by Dr. Paris is based upon the presumed mode in which individual poisons act.

i. Poisons which act through the medium of the nerves without being absorbed, and without exciting local inflammation. ii. Those which enter the circulation, and act through that medium with different degrees of force, on the heart, brain, and alimentary canal. iii. Those which act locally on the mucuous membrane of the stomach, exciting a high degree of inflammation.

tion of the mucuous membrane or epithelium, and an acrid and burning sensation in the mouth and fauces. These sensations and alterations extend more or less to the pharynx, and along the œsophagus; and the patient is incapable of swallowing, or, if he attempt to swallow, the matters are spasmodically rejected. When the poison is fluid, as a mineral acid or an alkali, the burning pain and change of structure rapidly produced in the mouth, throat, and œsophagus, and all the symptoms referable to those parts, precede disorder of the stomach; and in some instances the poison is not conveyed farther than the œsophagus, owing to its violent action on the pharynx, and the spastic contraction of this part and of the upper part of the gullet. When, however, owing to the peculiarities of the case, or to the less solubility or state of admixture of the poison, the mouth and throat are but little or slightly affected, the stomach then evinces the chief disturbance. Pain, sickness, or nausea, burning heat, and vomiting, are rapidly produced. In some instances the burning pain and acrid constriction extend from the mouth or pharynx, along the œsophagus to the stomach. The pain and vomiting follow immediately upon the passage of the poison into this viscus. The rejected matters consist at first of the contents of the stomach, with more or less of the poison, and subsequently of mucus and serum, often streaked with blood and mixed with bile, but frequently also altered by a portion of the poison being conjoined with them. Owing to the rapid rejection of its contents, and of the greater portion of the poison, the stomach may be chiefly or almost alone affected. This is the case, however, in comparatively rare occasions, for some of the poison most commonly passes into the duodenum, and often also into the small intestines, especially when the poison, as arsenic, is not very soluble, or is taken in an undissolved state; and in these circumstances some time may elapse between the ingestion of it and the occurrence of vomiting. But when this or any other poison is taken in such quantity and state as to produce a corrosive effect, the action on the stomach is manifested very soon after its ingestion; and is attended by more or less tenderness, tension, and soreness in the upper regions of the abdomen, and by a terrified or an anxious expression of countenance.

110. When an acrid or corrosive poison reaches the intestines—which may not occur when the poison is very active, and the lesion of parts above the pylorus is intense, and the shock to the vital endowment consequently great—most acute burning or lacerating pains more or less constant, but aggravated at intervals, are felt around the umbilicus or over the whole abdomen, and are attended by a sensation of twisting, sometimes by a feeling as if the intestines were drawn against the spine, and often by a distressing aching in the loins extending to the epigastrum. The abdomen is always tense and tender, but at first there is no swelling, but rather a retraction of the parietes; but distention from flatus generally supervenes. Purging is frequently present with tenesmus, and sometimes with excoriation of the anus. After feculent matters are passed the stools are mucous, watery, or serous, streaked with blood, or contain a considerable quantity of blood. The affection of the bowels may be the prominent effect, the stomach being comparatively but little disturbed; but more frequently the whole alimentary canal is affected, and vomiting and purging, with distressing pain and vital depression, are present at the same time.

111. As the operation of the poison proceeds painful and scanty micturition occurs; hiccough sooner or later appears, and becomes distressing; the pulse is rapid, small, and weak; the strength and spirits are prostrated, the features sunk, the surface is covered with clammy cold sweats, the extremities are cold and shrunk, and the voice fails. In cases where the poison excoriates the fauces, pharynx, or upper portion of the gullet during deglutition, the irritation often extends more or less to the epiglottis and glottis, producing wheezing or difficult respiration, hoarseness, or spasm of the glottis, and, in rarer instances, even death by asphyxia. It will appear from this that this class of poisons produce effects which may readily be mistaken for several of the diseases mentioned above (§ 68); and to the diagnosis between these effects and those diseases I shall next briefly advert.

112. *A.* Certain Lesions of the Stomach are attended by symptoms, especially near a fatal termination, very closely resembling those produced by corrosive substances.—(*a*) *Rupture and partial laceration of the stomach* may follow sooner or later after a full meal, and owing to the circumstance, as well as to the attendant phenomena, occasion suspicions of poisoning, which, however, an examination of the body after death readily disproves. Instances have occurred of persons who have eaten too largely, either after long abstinence, or after having suffered from dyspeptic disorder, and who have been seized with violent but ineffectual attempts to vomit, pain in the stomach, sudden collapse, and death in a short time, preceded by abdominal tumefaction and tenderness. On dissection, laceration of the coats of the viscus and the passage of the alimentary matters into the peritoneal cavity have been found. In the case described by M. Lallemand, which occurred after long privation and dyspeptic symptoms, the patient exclaimed that she felt her stomach tearing itself open. The laceration was five inches long; the coats were not diseased, but the pylorus was indurated. Dr. Christison refers to two cases in which the laceration appeared to have been caused by the accumulation of gases arising from depraved digestion. In these, as well as in cases where the distending matters have been more consistent, the laceration has been owing as much to weakened vital cohesion of the coats of the stomach as to the amount of the distending matters. Instances of rupture of the stomach have been recorded by Dr. Roberts and Mr. Weeks; and upon dissection no sufficient cause of the occurrence was detected. It may be, therefore, inferred that flatulent distention of the stomach having occurred, as it usually does, when the vital tone and cohesion of the organ are most impaired, spasmodic reaction or contraction of the parieties had taken place, during which laceration had been the result. The rupture may be only *partial*; as in the case related by Mr. Chevalier, where the symptoms of corrosive poisoning occurred after a very full meal, at-

tended by vomitings of blood towards its close. Upon examination after death, the inner coat of the stomach was torn in several places, and that of the duodenum was also extensively lacerated.

113. (*b*) *Rupture of the coats of the stomach at the bottom of a chronic ulcer, or perforation of the stomach*, may be attended by similar phenomena to those caused by corrosive poisons. 1st. The ulceration may have existed and been attended by paroxysms of pain, or of retchings, and when it had proceeded as far as the peritoneal coat, or partially through the muscular coats, the distention of a full meal, or of flatus, in connexion with efforts at vomiting, has produced *rupture of the tissue forming the bottom of the ulcer*, and the escape of the contents of the viscus into the peritoneal cavity. 2d. The ulceration may have gone on to *perforation* without any evidence of rupture or laceration. Perforation may, however, take place without the escape of the contents of the stomach into the peritoneal cavity; the peritoneal surface around the perforation having become agglutinated to an adjoining viscus, as in two cases which occurred in my practice.

114. *Perforations* of the stomach are described in the articles Digestive Canal (§ 36–43) and Stomach; it is, therefore, only necessary to state at this place, that the symptoms attending them in their course, and towards their fatal termination, should be carefully distinguished from poisoning; for the diagnosis is not always easy. Perforation occurs most frequently in females between 16 or 17 years, and 25 years of age, especially in the scrofulous diathesis, in the sedentary, and in connexion with disordered catamenia, and in delicate or weak constitutions. The severe symptoms, especially sudden and acute pains, retchings, or vomitings, anxiety, vital depression, &c., generally occur after eating or drinking, and especially after a full meal; and, if perforation has actually taken place, there is always vital shock or collapse, accompanied by the extension of pain and tenderness, with more or less tumefaction or tension, over the whole abdomen. In these cases, the advanced symptoms and death are results of the peritonitis caused by the matters which have escaped into the peritoneal cavity; and the vomiting is often slight, consisting chiefly or altogether of articles recently taken. There is seldom purging, which frequently accompanies poisoning, although constipation is not so generally observed as stated by some writers. The appearances found after death, and a careful examination of the articles partaken of, and of the matters thrown up, are the chief means of diagnosis.

115. *B.* Lesions of the Intestines and of allied Parts may be attended by symptoms resembling the action of corrosive poisons.—(*a*) The *duodenum*, as well as the stomach, may be ruptured, independently of external violence, without any other apparent cause than overdistention, and retchings while in this state. Dr. Christison refers to an instance of a man who was seized after dinner, when mentally excited, with violent pain in the stomach, vomiting, and failing pulse, soon followed by death. The mucous surface of the duodenum was much inflamed; and, four inches and a half from the pylorus, a laceration extending through a third of the circumference of the bowel was observed.

116. (*b*) The *passage of gall-stones*, and the violent pain, vomitings, and vital depression accompanying this affection, may suggest suspicions of poison; but the slowness of the pulse, or the absence of febrile symptoms, the tolerance of pressure in the region of the stomach, or the presence of jaundice, will, in some instances, indicate the nature of the case. Still these symptoms cannot be relied upon, and they may not be present; other circumstances duly investigated furnishing the chief sources of diagnosis. Besides, gall-stones may produce severe irritation, with abdominal or epigastric tenderness and tension, as well as pain and vomiting; and when these occur soon after the ingestion of food or drink, they furnish sufficient reasons for careful observation and examination on the part of the physician. An elderly lady, after slight jaundice, was suddenly seized with violent pain in the stomach, vomitings recurring in frequent fits, followed, after some hours, by most excruciating pains, incessant retchings, coldness of the skin, and failure of the pulse. In seven hours from the fresh accession of suffering she expired. The hepatic duct was found torn across, a gall-stone at the opening of the cystic duct, and three pounds of blood and bile in the peritoneal cavity, which was inflamed in different parts. (*Journal des Prog. des Sc. Med.*, t. xiv., p. 245).

117. (*c*) *The sudden flow of acrid bile into the duodenum*, especially during warm seasons, after this secretion had accumulated in the gall-bladder and ducts, is not infrequently the cause of symptoms which have been mistaken for the ingestion of acrid poisons. This is most likely to occur where a person who is subject to this biliary accumulation takes some article which disagrees with him, or some chologogue purgative. I have met with two or three instances of persons who complained of the symptoms I have described as diagnostic of biliary accumulation or obstruction (*see* Gall-bladder, § 18, *et seq.*, and Liver, § 48, *et seq.*, and § 78, *et seq.*), and for whom a moderate purgative dose was ordered. But the medicine having removed the obstruction, the passage of acrid bile into the duodenum occasioned symptoms of so violent a nature—retching and vomitings, diarrhœa, pains in the stomach and throughout the abdomen, &c.—as to suggest suspicions of an acrid or corrosive poison having been given, instead of the medicine prescribed. The bile which passed into the duodenum in these instances possessed sufficient acridity to occasion many of the symptoms of poisoning.

118. (*d*) *Bilious cholera* may likewise be mistaken for the effects of acrid or corrosive poisons; indeed, it is most difficult in many cases to distinguish between them, and still more difficult to point out any means of diagnosis which can be depended upon. Much will depend upon the acumen of the physician, and the view he takes of the history of the case, and all the circumstances attending it. The nature of the ingesta, and the state of the matters ejected, should be carefully inquired into; and if heat, acridity, or darting pains be felt in the mouth, pharynx, or œsophagus, their occurrence *before* or *after* the vomiting ought to be ascertained,

and the mouth and pharynx should be examined. These symptoms seldom even attend, and never precede bilious cholera; while they very frequently, indeed most commonly, precede poisoning with acrid or corrosive substances. Blood is never seen in the matters thrown from the stomach in cholera, whereas it is frequently seen in these matters when the vomiting has been caused by these poisons. Bilious cholera, or any state of cholera observed sporadically in this country, even when excited by indigestible articles of diet, rarely terminates fatally within 48 hours, and, indeed, very seldom thus terminates even in a much longer period, whereas the effects of corrosive poisons are much more rapidly fatal.

119. (*e*) *Pestilential cholera* is also liable to be mistaken for poisoning with acrid substances; but the same circumstances as have been just noticed serve to distinguish between them, with the exception of the rapid termination of the former, which is frequently equally rapid with the latter. But the prevalence and infectious nature of this pestilence, the general symptoms, the state of the surface and of the extremities, and the appearances and odour of the fluids thrown off during the progress of the malady, will readily distinguish it from poisoning, especially if the physician have seen cases of it on any former occasion.

120. (*f*) *Inflammation of the stomach, or of the intestines, or of the peritoneum*, may be confounded with poisoning with corrosive substances, the first of these more especially. Acute gastritis, uncomplicated with inflammation of an adjoining viscus, seldom occurs primarily in temperate climates, and not very frequently in warm countries, unless as a consequence of the excessive use of spirituous liquors or other stimulants; but it does occur more frequently both in England and Scotland than Dr. Christison has inferred from the statements of M. Louis. Acute gastritis sometimes is produced primarily—and formerly it was produced more frequently—by drinking excessively of spirituous liquors, and the severity of the symptoms were occasionally such as to equal the violence of those occasioned by acrid poisons; but the history of the case, the symptoms of intoxication, the odour and appearances of the matters rejected, &c., will sufficiently point out the nature of the affection. It must be admitted that the possibility of acute gastritis being produced by natural causes is a question of great interest and importance to the practical physician. Dr. Christison remarks, that the possible occurrence of this disease, independently of poison, is the only obstacle in the way of a decision in favour of poisoning when, in cases characterized by signs of violent irritation during life and early death, bright redness, ulcers, and black granular, warty extravasation are found in the internal surface of the stomach; and in regard to their effects he adds, that they can very rarely indeed all arise from natural causes, or, indeed, from any other cause than poison. Admitting the truth of this, I may state, that violent gastritic symptoms, death after some hours, with vascular injection, redness of the inner surface of the stomach, and numerous ecchymoses, have occurred, without sufficient evidence of poisoning, unless, in some instances, the excessive use of spirituous liquors be considered as such, and to which it is strictly entitled. When ulcers, excoriations, abrasions, or corrosions of the inner surface of the viscus are found, in cases which have terminated rapidly, and in connexion with bright redness, ecchymosis, &c., there can be little doubt of the ingestion of an acrid or corrosive poison, although it may have escaped detection. An important sign in cases of gastritis, as well as of cholera, is the absence of excessive heat or burning in the throat, or of painful and difficult deglutition; which very frequently precede the vomiting in cases of poisoning by acrid substances, and which seldom attend and never precede the vomiting from spontaneous gastritis or enteritis.

121. (*g*) *Acute enteritis, gastro-enteritis*, or *peritonitis*, may, in some instances, give rise to suspicions of poisoning; and the physician will consequently be induced to inquire, as in the diseases already noticed, 1st. As to the time at which vomiting appeared after a meal, or after the ingestion of any article whatever. 2d. As to whether the disease was ushered in by chills or rigours, or is attended by febrile reaction or commotion. 3d. As to the state of the bowels, of the evacuations, and of the matters thrown off the stomach. 4th. As to the symptoms referable to the mouth, throat, and œsophagus. 5th. As to the presence or absence of diarrhœa, and of excoriations at the anus; and, 6th, into all the circumstances connected with the history and existing state of the case. The causes assigned for the attack; the relations subsisting between these causes, and the supervention of chills or rigours, of vomitings, and of consecutive febrile reaction; the existence of constipation, and the absence of lancinating pains or burning sensations in the mouth, throat, and œsophagus at the commencement, and of painful and violent purging and excoriations of the anus at an advanced period, with other particulars connected with the history of the case, will distinguish most instances of spontaneous inflammation of the digestive organs and of the peritoneum from poisoning with acrid or corrosive substances.

122. (*h*) *Perforation of the intestines*, as well as perforation of the stomach, always terminates fatally; and when it is attended by symptoms simulating those which are caused by acrid poisons, an examination after death will show the nature of the case. (*See* Digestive Canal, § 40, *et seq.*, and Intestines, § 80, 81.)*

123. (*i*) *Colic, iliac passion, and strangulated hernia* may severally be mistaken for poisoning with corrosive substances, especially when they are attended by violent retchings or vomiting; or poisoning by these substances may be mistaken for these. *Internal strangulation, intus-susception of a portion of intestine*, and the existence of *intestinal concretions*, or other causes of obstruction, may likewise occasion symptoms closely resembling poisoning, especially the vomitings, pain, anxiety, and vital exhaustion attending them. But the history of the case, the obstinate constipation, the appearances and odour of the matters thrown off the stomach; the sensations of the patient as to the seat of obstruction and pain; and the lesions found after death, with the other cir-

[* This statement is too broad; perforation of the intestines, though generally, is not always fatal.]

cumstances already adverted to, will serve to distinguish these maladies from the effects of poisons.

124. Having taken a view of the features distinguishing certain natural diseases from the effects of corrosive or acrid poisons, I should now proceed to describe the *structural lesions* produced by these latter; but as these lesions differ very remarkably from each other, according to the particular substance causing them, I shall briefly notice them in connexion with the especial consideration of the several substances acting chiefly by their corrosive or acrid properties, or by the *local changes* produced in the viscera, with which they are brought in contact; and for facility of reference, I shall treat of them in alphabetical order.

125. i. Acids.—*A.* Acetic Acid, in its concentrated state, *acts* chiefly as a corrosive agent. Although, in its various forms, it is in daily use, it is rarely the cause of death, even when swallowed by mistake in considerable quantity. Its injurious effects have been described by Orfila, Barruel, Schubarth, and Hébréart.

126. *a.* According to the last-named experimenter, a small quantity of acetic acid dropped into the *windpipe* occasions difficult and hissing respiration, croupy cough, and death in two or three days, the surface of the larynx and trachea being covered with a false membrane similar to that found after croup.

127. *b.* The concentrated acid, *applied externally*, acts as a corrosive agent on the tissues. In this state it operates chiefly locally, dissolving the albumen, fibrin, and gelatin; and is but slightly absorbed. It coagulates, and renders dark the blood in the capillaries.

128. *c.* If *injected into the veins* in a strong or concentrated state, or if the quantity be considerable, it changes the physical appearances of the blood, and alters the colour and condition of the red globules. According to Dr. Pommer, when it is dilute, or about the strength of the distilled vinegar in common use, several ounces of it may be injected into the blood without material mischief; but the more recent experiments of Orfila throw much doubt upon this inference.

129. *d.* Acetic acid *taken into the stomach* in large quantity, but more especially in a very concentrated state, and if the stomach be empty, produces agonizing pain, and a sensation of burning in the stomach, with anxiety at the epigastrium, and convulsions, and death after a few hours. In this concentrated state it acts chiefly locally, and is not absorbed in an appreciable degree. It affects violently the nerves of the organ, the affection being propagated to the large visceral ganglia; and it coagulates the blood in the capillary vessels of the organ, and arrests the circulation through them, occasioning also a vital shock. In dilute states and in frequent doses, this acid acts chiefly through the medium of the blood, lowering nervous energy and vascular action, as will be shown hereafter. (See next Class.)

130. *e.* The *appearances after death* by the concentrated acetic acid are, lividity of the integuments of depending parts of the body; a brownish and leathery appearance of the mouth, fauces, and pharynx; and a similar change extending down the œsophagus to the stomach or to parts of this viscus. The inner surface of the œsophagus presents large patches of a dark-brown hue, with reticulations of injected capillary vessels. The stomach, in some places, has a grayish tint, interspersed with dark-reddish spots, with numerous ecchymoses, and several large, black elevations, consisting chiefly of coagulated blood in the sub-villous cellular tissue. A livid or black hue of the fundus or near the pylorus; a thick, dark, pulpy matter adhering to parts of the internal surface of the organ; and the presence of more or less of the acid in this viscus or in the intestines, have also been observed. The intestines are not materially altered.

131. *f. Treatment.*—Draughts containing calcined magnesia, or the alkaline or magnesian carbonates; the cautious use of the stomach-pump, as the villous surface of the œsophagus and stomach is readily injured by mechanical agents after corrosive poisons; the injection of magnesian or alkaline solutions, and the removal of the contents of the viscus soon afterward by this apparatus, are the measures more immediately required. Subsequently, albuminous or demulcent fluids, mild broths, arrow-root, sago, and various mucilaginous and farinaceous articles of diet, may be given in small quantities, and frequently.

132. *B.* The Hydrochloric, the Nitric, and the Sulphuric.—As these acids, usually denominated the *mineral acids*, when used in poisonous states and quantities, produce similar phenomena, and require the same means for the counteraction and removal of their effects, I shall consider them under the same head, and, in some respects, in connexion. *Hydrochloric acid—muriatic acid—spirit of salt*—is not infrequently employed as a poison; but the *nitric acid—aquafortis*; and the *sulphuric acid—vitriolic acid—vitriol—oil of vitriol*, are not infrequently resorted to, for purposes of murder or suicide, or of external injury short of murder. Either of these acids may be swallowed by mistake, or be employed in various criminal ways. Tartra adduces an instance of a female who, having been intoxicated, was poisoned by nitric acid, which was mixed with wine and poured down her throat. A woman was convicted of murdering her husband by pouring sulphuric acid down his throat while he lay asleep with his mouth open; and several instances have occurred of the same acid having been given in poisonous doses, in place of the medicines which had been prescribed. The mineral acids, especially the sulphuric, have likewise been employed, by abandoned persons, to poison their own infants; but they are much more frequently resorted to as a means of suicide. They have also been employed, from motives of revenge or of dislike, to disfigure the countenance or person; the concentrated acid being squirted or thrown over exposed parts of the body. Mr. Taylor states that the external application of nitric acid has been a criminal cause of death on many occasions. In one instance this acid was poured into the ear of a person while sleeping, and it led to the slow destruction of life.

133. *a. The symptoms* occasioned by the mineral acids, *when swallowed in a concentrated form*, are of the most violent description, but the alterations produced by them on the organization are chiefly local and structural. Dr. Christi-

son justly remarks, that they afford the purest examples of true corrosive poisons, their poisonous effects depending entirely on the organic injury they occasion in the textures to which they are applied; and that it is of use to set out, in the investigation of the effects of poisons, by determining the phenomena presented under such circumstances. I shall have more immediately to describe the violent symptoms and the severe structural change produced by these substances before a fatal result ensues; and in the sequel to show the much less violent phenomena, and the very slight local signs which other poisons hitherto classed with these leave of their operation, and yet prove more rapidly and certainly fatal than they; and few will fail of being struck by discovering the great extent of lesion the animal frame will sometimes endure from the former—the most violent of all corrosive substances—and yet recover; and the very slight alterations locally produced by these other poisons, whose operation is so rapidly fatal. These circumstances will of themselves prove sufficient to warrant an arrangement in which substances differing so very materially in their local and constitutional effects as those alluded to should not be classed, as they hitherto have been, under the same head, but should be arranged under different classes, according to their most prominent mode of operation and effects.

134. *b.* The mineral acids may produce fatal effects when *applied externally*, when *injected into the veins or into mucous canals*, when *inhaled in the form of fumes*, and when *swallowed*. When *applied externally* in a concentrated form, or even in a state of strong dilution, they irritate, corrode, or inflame the skin. The nitric, or rather the strong nitrous or fuming nitrous acid, produces these effects most severely; but the sulphuric and hydrochloric act almost as violently as it. In the stronger states these acids chiefly act locally and disorganize the tissues, the coagulation of the blood in the capillaries and the destruction of the organization on which they act generally preventing their imbibition and absorption.

135. *c.* When *injected into the veins*, even in a state of considerable dilution, they coagulate the blood, and thus destroy life; but when the dilution is still greater, or such as to allow of the circulation and presence of either of these acids in the vessels of the heart, ganglia, or brain, before coagulation even partially takes place, it may reasonably be inferred that the vital manifestations of these organs will be thereby rapidly subverted.

136. *d. If the fumes of either of these acids*, or any of the gaseous forms which they assume, either singly or in states of admixture with other gases or vapours, be inhaled, the most severe effects on the respiratory passages and lungs are produced. When either nitric oxide gas, or nitrous acid vapour, hydrochloric acid gas, chlorine, or sulphurous acid, in more or less strong states, is attempted to be inspired, spasm of the glottis is produced by it, and its entrance into the respiratory organs is thereby prevented. In a weaker form, either of these acid vapours may pass into the lungs, but it irritates and inflames the mucous surface of the larynx and trachea, the inflammation extending along the bronchi to the air-cells and lungs, producing dangerous or even fatal laryngitis, bronchitis, or pneumonia, or a complication of these. Several instances are on record of persons having been destroyed by the violent and extensive inflammation of the respiratory surfaces produced by these fumes, and by the nitric oxide gas converted into nitrous acid vapour by mixing with the atmosphere.

137. *e. The injection of either of these acids into mucous canals* with a criminal intention has been rarely recorded. But an instance is published in the *Medical Gazette* (vol. xvii., p. 623), abridged from a French journal, of sulphuric acid having been given in an enema by mistake for oil. As soon as the enema was injected, the patient uttered distressing screams, passed the night in the utmost agony, and died in the course of the following day. Numerous instances have been published of the murder of children with sulphuric or nitric acid, chiefly the former, which has generally been poured into the mouth or throat. When poisoning is effected in this way, the acid may not reach the stomach; it may not even get farther than the pharynx or upper portion of the œsophagus. Being poured into the mouth or throat of the child when asleep, or when crying or struggling, a portion of it irritates the epiglottis, or even escapes into the glottis, occasioning strangulating cough, and asphyxia by closure of the glottis, with violent inflammation or disorganization of the pharynx and adjoining parts, as observed in some cases when acid has been swallowed accidentally.

138. *f. When either of these acids*, or an *admixture of these acids, has been swallowed*, the effects vary conformably with the circumstances mentioned above (§ 51, *et seq.*). These effects have been most ably investigated by Tartra, with reference more especially to *nitric acid*, which, as well as the sulphuric and hydrochloric, may be employed for the purposes of suicide, or of murder, or may be swallowed accidentally. However taken, with whatever motive, or in whatever quantity or degree of concentration, the acid may not, especially when taken accidentally, reach farther than the pharynx or œsophagus, its acridity, the violence of its effects, or the discovery of a mistake arresting deglutition before any portion of it could have reached the stomach. Nevertheless, fatal results may rapidly ensue owing either to the extensive disorganization of textures in, and adjoining to, the pharynx, or to the inflammation or corrosion of the larynx, the tumefaction of these parts closing the glottis, and either causing or threatening asphyxia. In these cases, although the acid may not reach farther than the upper part of the œsophagus, the effect upon the larynx may be so violent as rapidly to produce suffocation, if tracheotomy be not performed. M. Tartra considers that the mineral acids produce effects which may be arranged as follows: 1. Speedy death from violent corrosion and inflammation. 2. Slow death from a peculiar organic change of the stomach and intestines. 3. Imperfect recovery, the person remaining liable ever after to irritability of the stomach. 4. The recovery of perfect health; but the operation, by means of asphyxia, caused in the way now stated, should be ranked as a *fifth* mode or variety.

139. *g. The most common symptoms are those*

of the first of these varieties, namely, burning pain, and acrid acid taste in the mouth, extending to the throat; extreme heat and pain between the sternum and spine, extending to the epigastrium and stomach, where it is most excruciating, and attended by extreme anxiety, by most painful or impossible deglutition; and an increase of these on attempts to swallow, on pressure, and on coughing. Eructations often take place from the stomach, and aggravate the sufferings of the patient, especially in the situations just named. The lips are commonly shrivelled, and are, at first, whitish, and afterward yellowish, if nitric acid have been taken; and brownish, if sulphuric acid. Excoriations or corrosions, but rarely blisters, are sometimes observed on or about the lips, or on parts of the skin with which the acid may have come in contact, as the cheeks, neck, breast, or fingers; and these marks undergo the same change of colour as observed in the lips and mouth. The inside of the mouth and of the cheeks is also more or less shrivelled, white, or corroded; and the teeth often in a very few hours become loose, brown, or yellowish-brown. The colour of the tongue varies with the acid, and the time which has elapsed from the application of the acid; but it is often yellowish, or yellowish-brown. Deglutition is so difficult, that attempts to take fluids are followed by the forcible rejection of them by the nose, the pharynx being spastically contracted. The matters vomited are generally brownish or black; and if they fall on marble or limestone, they produce effervescence. Afterward they are mixed with altered blood, and with membranous shreds, which resemble portions of the villous coat of the stomach, and sometimes actually consist of these, but most generally of coagulated mucus. The bowels are obstinately constipated, and the urine is scanty or suppressed. The abdomen, especially its upper regions, is tender and swollen. The pulse is very weak, and, toward the close, very small, imperceptible, or intermitting. It is seldom very frequent, and it may even continue but little or not at all accelerated throughout. The countenance, at first expressive of anxiety, pain, and distress, soon becomes collapsed, pale, and the extremities cold or clammy. The breathing is laborious, is often attended by singultus, and the movements of the diaphragm increase the pain of the stomach and epigastrium. In many cases the irritation and swelling in the pharynx and epiglottis, or even in the larynx, cause fits of suffocative cough, with croupy respiration, and, where the larynx has been more particularly injured, suffocation may not merely be threatened, but actually produced.

140. In some instances, especially when the quantity of acid which has passed into the stomach has been large, the symptoms may be less excruciating, but more rapid; while in others there may be a deceitful tranquillity, and life may be somewhat longer sustained. Thus, in the case adduced by Tartra, of a woman who had been intoxicated, and was poisoned by aqua-fortis mixed in wine, although there were both pain and vomiting at first, yet none of these symptoms were afterward complained of, death taking place within twenty hours; but the intoxication probably obscured the sensibility, while the admixture with much wine modified the operation of the poison. The intellectual faculties generally remain unimpaired to the last. Should the patient survive the first effects of the poison, the mucous membrane of the fauces, pharynx, or œsophagus may be detached and discharged in irregular shreds, or in portions of considerable size, or even in a perfect cylinder.

141. *h. The duration* of this variety of corrosive poisoning may vary from two or four hours, as in the cases recorded by Remer and Sinclair, to two or three days; but life may be prolonged to ten or fifteen days. The usual period is from twelve to forty-eight hours. *Death* may be caused altogether by asphyxia, owing to the closure of the larynx, [the acid not reaching the stomach]; and if tracheotomy be resorted to, life may be thereby prolonged, as in the case recorded by Mr. Arnott; but death more frequently results; the structural change, the violent impression made upon the nerves, the vital shock, the coagulation of the blood in the vessels of the parts with which the acid came in contact, and the local arrest of the circulation and of the associated vital functions, combining to produce the fatal issue. [In these cases death generally results very speedily, often within a few minutes.]

142. *i.* The *quantity* of a mineral acid capable of producing fatal effects cannot be stated with any precision, as the result depends upon the several circumstances stated above (§ 51, *et seq.*). Dr. Christison remarks that the smallest fatal dose of sulphuric acid which he has found recorded, was one drachm, which was taken with sugar by mistake for stomachic drops by a stout young man, and produced death in seven days. A man has recovered after taking six drachms. In a case of poisoning with hydrochloric acid, an ounce and a half proved fatal in about twenty-four hours; and in another case, alluded to by Taylor, a man walked about three quarters of a mile after taking nearly an ounce. Mr. Orr and Dr. Craigie refer to two cases of recovery, although two ounces of the concentrated sulphuric acid had been swallowed in each.

143. *k. The symptoms of the second of these varieties*, according to Tartra, are at first those already described, but they soon abate in violence. The patient then becomes affected with general fever, dry skin, difficult breathing, tension of the abdomen, spasms, and pains of the limbs, salivation, and occasional vomiting, particularly of food and drink. The salivation is attended by fetor, and membranous flakes, resembling the villous coat of the stomach, are vomited. These flakes are most probably membranous exudations of lymph, resembling those of croup, thrown out on the excoriated and inflamed surface of the organ. Worms are sometimes discharged dead and excoriated by the acid. The functions of digestion and assimilation are arrested, or remarkably impaired, and the frame becomes extremely debilitated and emaciated. Death usually takes place in periods varying from a fortnight to several months. Tartra adduces an instance in which death did not take place until after eight months, the vomiting of membranous flakes continuing until the last.

144. *l. The third and fourth varieties* described by M. Tartra are characterized, as respects the *former* of these, chiefly by the greater mildness of the symptoms from the commencement, and

by the patient continuing through life liable to attacks of pain in the stomach, vomiting of food, and general disorder of the digestive functions. The *latter* consists of cases of perfect recovery. Of 55 cases of poisoning by the mineral acids recorded by Tartra, 26 died; 19 of the primary, and 7 of the secondary effects. Twenty-nine recovered, and of these 21 perfectly. Suicidal cases, for obvious reasons, were more frequently fatal than the accidental.

145. *m.* The strong mineral acids, as above mentioned (§ 137, 138), *may not reach the stomach*, especially when the poisoning is accidental or attempted criminally. The effects produced by them, under these circumstances, upon the pharynx, œsophagus, and larynx, being often so violent as to occasion death in a few days. Several instances of this kind have been recorded; and even when a person has discovered his mistake, and taken only a small portion, which could have reached no farther than the pharynx or upper part of the gullet, partial recovery may take place, with stricture of the upper portion of the œsophagus; or fatal inflammation of the pharynx and larynx, with or without asphyxia, may be the immediate result. That a large proportion of the children poisoned, by the abandoned classes, with the mineral acids, die from the effects of the poison on these parts, without reaching the stomach, is proved in some cases by the appearances observed after death, and is rendered probable in others by the circumstances under which the act is perpetrated. In the case recorded by Mr. Arnott, the injury was confined chiefly to the larynx and gullet, the stomach being distended with food and very little affected. The symptoms were general depression, with croupy respiration and threatened suffocation, for which tracheotomy was performed, with relief to the breathing; but the patient died, with symptoms of general exhaustion, in thirty-six hours, without presenting any marked signs of the operation of the acid on the stomach.

146. In the circumstances and in the concentrated form, in which the stronger mineral acids are poisonous, whether taken accidentally, or with a suicidal intention, or given with a criminal object, danger or death arises chiefly from the local or structural change; comparatively little of the acid, as stated above (§ 134), being carried into the circulation. But these acids may be taken in such states of *dilution* as will admit of their absorption, and action on the frame through the medium of the blood; and thus they may produce noxious effects, especially when given frequently, or in too large quantity, or a form of *slow poisoning;* but as they do not act by producing a corrosive effect, when given in states of dilution which admit of their absorption, they will be considered, in this form of exhibition, under the class to which the different effects they then produce more appropriately belong.*

147. *n. Appearances after death from the concentrated mineral acids* may be confined chiefly to the fauces, pharynx, larynx, and œsophagus, and may be comparatively slight in the stomach. The whole of the alimentary canal, from the mouth to the anus, should be examined, and the lesions of the upper portions should be carefully observed; as these portions, especially those particularized, suffer most in cases of poisoning with these substances. Spots on the skin, about the mouth and lips, are often present, and should be examined. If the case have proved fatal within the usual period, and if the *concentrated sulphuric acid* have been swallowed, the inner surface of the mouth is generally white, softened, and corroded, the mucous coat is readily detached, and the tissues underneath are of a dark red. The same change is observed in the fauces, pharynx, and œsophagus, the colour of the mucous surface of these parts sometimes being brownish or ash-gray. The mucous membrane is often more or less corroded, partially detached, and, in the œsophagus, assumes longitudinal plicæ, owing to the contraction of the canal and its partial detachment. The stomach is usually contracted, corroded, and sometimes perforated. When opened, its contents are commonly of a dark brown or black hue, of a tarry consistence, and consisting chiefly of altered blood and mucus. The existence of acidity depends upon the treatment and the period which had elapsed from the ingestion of the acid. The villous surface of the stomach is traversed by black striæ, is more or less corrugated, or is generally of a brownish or black colour, which is not removed by washing. Between the rugæ and underneath the blackened membrane, the issues are of a deep or dark red hue; but this redness and the blackness of the villous membrane are sometimes partial, or in patches of various extent. The small intestines, especially when much of the acid has passed into the stomach, are more or less inflamed, their contents much resembling those of that viscus. When perforation of the stomach has taken place, all the coats are much softened, especially in the vicinity of the perforation, the margins of which are black, irregular, and very soft. The contents of the viscus may not have escaped through the aperture; but if they have passed through, the adjoining organs are generally altered by the acid. Mr Taylor refers to a case in which the spleen, the liver, and the coats of the aorta were found corroded and blackened by the acid which had escaped through the perforation.

148. When the acid has been taken in a diluted state, or at least in a less concentrated form, and if the patient live some days or weeks, the œsophagus is more or less constricted, and its mucous surface inflamed or otherwise changed. Inflammatory lesions are commonly found in the stomach, and the corrosion or charring of the villous membrane is not so great as described above. The blood in the vessels is always very dark; that in the vessels of the stomach and spleen is almost black and coagulated. In the more prolonged cases the villous coat of both the œsophagus and stomach is either more or less abraded, ulcerated, or almost entirely destroyed. The pylorus is generally constricted. In these cases the patient sinks from the irritability of the stomach, from the almost total arrest of the functions of digestion and assimilation, and from the action of the acid upon the blood and nervous systems. In some, at least, of these cases, and especially when the acid has been much diluted, a partial absorption of it into the circulation takes place, and changes the colour

[* In these cases they may readily be detected in the urine.—*Lond. Med. Gazette, May* 27, 1842.]

and state of the blood, and acts otherwise injuriously on the frame, as will be noticed more fully in the sequel.*

149. *o. The appearances produced by the nitric and nitrous acids* are not materially different from those caused by sulphuric acid. The external surface of the lips often present yellowish or yellowish brown spots, the cuticle being easily detached. Yellowish spots are sometimes found about the neck, or on the hands. A yellow frothy liquid escapes from the mouth and nose. The abdomen is often distended with flatus. The inner surface of the mouth and cheeks is of a whitish or yellowish colour. The pharynx, larynx, and œsophagus are softened, tumefied, of a yellowish or brown colour, and their mucous membrane is easily detached, or it is already detached in long shreds or folds. The stomach is similarly altered. It is rarely perforated, and is often distended with gas. The villous membrane presents extensive patches of a yellowish, brown, green, or black hue, and the coats of this viscus are remarkably softened throughout. The duodenum is often changed in a similar manner, although not so extensively; the other intestines are seldom much altered. The non-perforation of the stomach is most probably owing, as Mr. TAYLOR suggests, to the circumstance of the acid having been swallowed, in most instances, while the stomach contained much alimentary matters. When death takes place rapidly, the contents of this viscus generally yield more or less of the acid. When the larynx is implicated by swallowing this or any of the other strong mineral acids, more especially if suffocation have been thus produced, the lungs and mucous membrane of the trachea and bronchi are congested with black blood. In more chronic cases, especially if the patient has lived several weeks, softening, redness, and ulceration in various stages of the mucous membrane of the œsophagus and stomach are found. The œsophagus is often constricted, and constriction is sometimes, also, met with in the pylorus and duodenum.

150. *p. The hydrochloric acid* produces similar symptoms and appearances after death to those which have been now described. Cases of poisoning by this acid are much more rare than by the other strong mineral acids; but those which have been observed with due attention present the same phenomena and lesions as are produced by nitric acid.

151. *q.* Instances of poisoning by an *admixture of mineral acids*—by the *nitric and muriatic acids—aqua regia*, which is often used in the arts for dissolving gold and platina—and by the *nitric and sulphuric acids—aqua regiæ*, which is employed for dissolving silver, may occur, but they have been very rarely met with. ORFILA has given one instance of poisoning by the latter of these combinations. The symptoms and post-mortem appearances were much the same as those already stated, but approached the nearest to those caused by the nitric acid, which predominated in the mixture. The *nitro-muriatic acids* most probably produce symptoms and changes very closely resembling those described above, especially those in connexion with nitric acid (§ 139–149);* but they have not hitherto been recorded.

152. *r. Treatment.*—The difficulty of swallowing, in almost every instance of poisoning by these acids, is the great obstacle to the treatment of their effects. The means and the intentions which should guide the employment of them are obvious; but when the constriction of the pharynx and the spasmodic action of the pharyngeal muscles are such that all articles are forcibly rejected upon every attempt to swallow them, the most influential antidotes and remedies are altogether prevented from exerting their effects. If, however, the patient be still able to swallow, calcined magnesia, or the carbonate of magnesia, should be instantly given in milk, or in any mucilaginous fluid; but if these are not immediately to be procured, finely-powdered chalk, whiting, common soap or soda should be substituted, and taken in milk, or in water, or in oleaginous or mucilaginous fluids, according as either may be in instant readiness. The success of treatment entirely depends upon the rapidity with which the *antidote* is administered. Oleaginous and mucilaginous fluids should be freely administered. Linseed or olive oil, linseed tea, gruel, milk, [flour and water], are severally of use when they can be swallowed, either alone or as the vehicles of the antidotes just named.

153. If swallowing be impossible, owing both to the constriction and to the tumefaction and irritability of the pharynx and œsophagus, the propriety of introducing the remedies now mentioned by the tube of the stomach-pump into the stomach should be considered. The tumefaction of the coats of these passages, the corrosion and softening they have experienced, and their partial detachment, and the frequent recurrence of severe singultus, are often such as almost to preclude the introduction of the tube, and to risk perforation of the canal in the attempt. ORFILA, in 1817, recommended a recourse to the stomach-pump, which, however, was first proposed by BOERHAAVE, and strongly advised by RENAULT and DUPUYTREN shortly before the recommendation of ORFILA. But, although thus approved of, this apparatus appears never to have been brought into use until

[* The following case is reported by Dr. TOOTHAKER, in the Boston Med. and Surg. Journal, vol. xv., p. 270. An ounce of the officinal muriatic acid was swallowed by mistake, and immediately succeeded by violent burning of the mouth and fauces, a sense of suffocation, and spasms. Olive oil was given, followed by milk and water, thickened with calcined magnesia. Copious vomiting succeeded. An emetic was next administered, and this again followed by magnesia. The strength was greatly reduced, and the extremities so cold as to require the application of sinapisms. The next day there was pain and costiveness, but these were relieved by a dose of castor oil. After this, the patient gradually recovered, although not without subsequent symptoms consequent upon the action of the corrosive substance which he had taken.]

* The plan of my work and my limits prevent me from entering upon the *chemical analysis and tests* of the several poisons. If these several topics cannot be fully discussed with reference to the states, combinations, &c., in which poisons should be investigated by the medical jurist, and to the various objections which may be urged against certain methods of analysis and tests, in ever varying circumstances, they should be entirely relinquished; and it is preferable that the reader should consult either of the able productions of BECK, CHRISTISON, ORFILA, DEVERGIE, TAYLOR, and GUY, as to these matters, than that I should give an insufficient account of them; and to such an account my limits must necessarily have confined me.

[The American reader will have little cause to regret the omission of this part of toxicology, inasmuch as the works of TAYLOR, BECK, and GUY are in almost every medical library. The editor would particularly recommend the recent work of TAYLOR on Poisons, as containing everything needed or known on this important branch of medicine.]

1822, when its utility was demonstrated by the practitioners mentioned above (§ 100) It is obvious that the prospect of having recourse to it with advantage, in the circumstances now under consideration, must depend upon the peculiarities of the case, and the acumen and dexterity of the surgeon.

154. When the larynx is affected, causing lifficulty of breathing approaching to suffocation, *tracheotomy* should be performed ; nor should this operation be then delayed, as prolonged difficulty of breathing causes more or less congestion of the lungs and bronchial membrane, which always accelerates a fatal issue, which issue the lesions of the stomach and œsophagus might not otherwise have produced.

155. Having neutralized the acid, our chief endeavours should be next directed to the removal of the effects which may be inferred to have been produced by it. Mucilaginous fluids, almond or spermaceti emulsions, gruel, decoction of marsh-mallows, gum-water, sugared water, thin broths, especially veal broths and jellies, may be severally given, and warm baths may be allowed. If the patient complain of colicky pains, of dysuria, or of tenesmus, starch, or other demulcent and oleaginous enemata, especially those with olive oil, with gruel or with veal or mutton broths, &c., should be administered from time to time ; for, under any circumstance of the case, these enemata will be of service.

156. The symptoms of *pharyngitis*, or of *œsophagitis*, or of *gastritis*, or of the association of these affections, which frequently continue until either a fatal issue or recovery results, should be treated conformably with the principles advised for these maladies. But generally the amount of vascular depletions required for the idiopathic sthenic inflammations of the alimentary canal is not required after poisoning by these strong acids. The frame has received both a severe injury of its violent organs and a violent shock ; and the former generally prevents the reaction usually consequent upon the latter. Hence venesection may not be required, or it may even be dangerous : the habit of body, strength, age, and circumstances of the case, in connexion with the degree and character of existing vascular action, being the guides to the adoption either of this practice or of moderate local depletions, or merely of emollients, of demulcent broths, of mucilaginous diluents, of gelatinous and farinaceous articles, and of external derivatives.

157. The irritability of the stomach, and the spasms and pains of the voluntary muscles and extremities which often continue for several days, both in cases which recover and in those which end fatally—these pains and spasms being caused by the injury and irritation sustained by the visceral or ganglial nerves, the morbid conditions of these nerves being extended to the sensory nerves, and reflected upon the voluntary muscles by the motory nerves—are among the most distressing symptoms which are afterward experienced, and are alleviated with the greatest difficulty. In these circumstances, emollient and tonic substances may be given in small and frequent doses, with opium or the tinctura camphoræ composita ; or the simple infusion of roses may be prescribed, with tinctura opii ; or the compound tragacanth powder, with the pulvis cretæ compositus cum opio, &c. ; and warm terebinthinate epithems or embrocations should be repeatedly applied to the abdomen. Nourishment of a mucilaginous, gelatinous, or demulcent kind should be taken in small quantity and at short intervals ; and if deglutition continue difficult, strong broths and animal decoctions ought to be administered *per anum*. For this latter important and sometimes fatal affection, the emollient linctuses and other means recommended for *acute and chronic inflammations and stricture of the œsophagus* (art. Œsophagus, § 43, *et seq.*), may be appropriately had recourse to. (*See*, also, Stomach, *Diseases of*.)

[We have treated three cases of poisoning by sulphuric acid, two of which died and one recovered. The poison was drank from a vial, by accident in every case, and the quantity swallowed from one to three drachms. The symptoms were those detailed above. Death occurred in one case from the inflammation extending down the trachea, causing all the symptoms of croup, and causing death by suffocation, about the 5th of August. In the other fatal case, death occurred on the third day, from acute gastritis. In the case of recovery, alkalies, as whiting, with abundance of mucilage, were freely and early administered.]

158. *s. Sulphate of Indigo.*—Poisoning by this substance is chiefly accidental. Mr. Taylor has observed that, as this compound is nothing more than a solution of indigo in sulphuric acid, the symptoms and post-mortem appearances caused by it are the same as those which have been described as produced by the latter substance. Poisoning by it may be suspected when, with these symptoms, the internal surface of the mouth has a blue colour, the vomited matters also having a deep blue tint. In two instances, in which about an ounce each was swallowed, death took place : in one case, eleven hours afterward, and in the other in seven hours and a half. It was remarked that the urine which was passed had a bluish tinge, indicating the absorption of some portion of this compound into the circulation. The *treatment* of poisoning by the sulphate of indigo is not different from that directed for the effects of the mineral acids.

159. *C.* Oxalic Acid.—Poisoning by this acid is generally accidental or suicidal. Of nineteen cases of poisoning by this substance in the coroners' return for 1837 and 1838, fourteen were suicidal. Owing to the resemblance of this acid to Epsom salts, it has sometimes been taken for them. Mr. Taylor thinks that its intensely acid taste prevents it from being often used with criminal intentions, although he has known several instances of murder having been attempted by it.

160. *a. The symptoms* are immediate, and so intense as often to have destroyed life before the arrival of the practitioner. If the poison be taken in large quantity—from half an ounce to an ounce dissolved in water—a burning acid sensation is felt in the fauces, throat, and œsophagus, followed immediately by vomiting. In some instances the impression of the acid on the stomach has been so intense as to paralyze this viscus, and the parts associated with it in the act, and little or no vomiting has occurred, death, however, rapidly taking place ;

in other cases, the vomiting has been incessant until death. The vomited matters are intensely acid, and have a green, or nearly black, colour, consisting of the alimentary substances, and afterward chiefly of altered mucus and blood. Extreme anxiety, pain, and tenderness are felt at the epigastrium; and often, in both, hypochondria, followed by spasms, singultus, convulsions, collapse of the features, and of all the vital actions, by clammy perspirations and cold extremities. Attending these there are often, also, stupor, unconsciousness, a small, irregular, and almost imperceptible pulse, deep and slow respiration, numbness of the limbs, and death.

161. In smaller quantity, and in somewhat greater dilution, the sensation of acidity, of burning in the throat, and the vomiting varies accordingly. Should the patient survive some time, owing either to the quantity of the poison taken, to the presence of food in the stomach, or to the discharge of the greater portion of the acid by vomiting, soreness and constriction of the throat, painful and difficult deglutition, irritability of the stomach, thirst, tenderness at the epigastrium, hiccough, diarrhœa, flatulence, and great depression of the vital powers are the most constant symptoms. Soreness of the mouth, swelling of the tongue, and numbness and tingling of the limbs, are often also experienced; the patient either dying after two, three, or several days, or slowly and altogether recovering. But recovery is generally attended and followed by more or less disorder, or tendency to disorder, of the digestive organs.

162. *b. The quantity of oxalic acid* which may destroy a human life has not been determined. The immediate rejection or the retention of the poison by the stomach, and the promptness or absence of medical aid, necessarily determine the result. Mr. Semple recorded a case in which two drachms, dissolved in water, were swallowed. Vomiting took place immediately, and the symptoms had nearly disappeared in about twelve hours. A man swallowed three drachms; vomiting instantly occurred, and he recovered in a few hours. A girl is stated by Dr. Babington, of Coleraine, to have taken forty grains: severe symptoms of gastric irritation supervened; but although, as in the other cases, medical aid was procured, the recovery was protracted. Mr. Taylor states, that a smaller dose than half an ounce generally has not been fatal; although it may be inferred, from the very dangerous effects caused by much smaller quantities, that much less than this may destroy life, if judicious treatment be not resorted to. When the dose of this poison is upward of half an ounce, death is commonly the result; but instances of recovery have occurred where the quantity was much greater than this, and judicious treatment has been promptly administered.

163. *c. The period at which death may take place* varies with the circumstances already alluded to. Dr. Christison mentions a case where an ounce of this poison killed a girl in thirty minutes, and another where the same quantity was fatal in ten minutes, this being the shortest period on record. When the dose is half an ounce, or upward, death commonly takes place within an hour or two. But instances have occurred in which life has been prolonged for thirteen or fourteen hours. Mr. Frazer has recorded a case which was prolonged to twenty-three days; irritability of stomach, singultus, fever, and exhaustion being the prominent symptoms.

164. *d. Appearances after Death.*—The mucous membrane of the mouth, fauces, and œsophagus is usually white; but it is sometimes partially covered by the dark matters discharged by the stomach. This membrane may be readily detached in these situations, as well as in the stomach. This organ is commonly much softened and pulpy, and contains a dark-brown, acid liquid resembling coffee-grounds, from the admixture of altered blood with it. Blood-vessels are seen ramified distended by coagulated, black blood. In a case where nearly two ounces were taken, and death was rapid, the coats of the stomach presented nearly as carbonized an appearance as that occasioned by sulphuric acid. The œsophagus presents similar changes. It is generally pale, seems as if boiled in water, and its inner membrane is raised in longitudinal rugæ or folds, interrupted by patches of abrasion. The upper portions of the intestines, especially the duodenum, are sometimes slightly inflamed or softened, but they are not otherwise remarkably altered. In Mr. Frazer's case, in which life was prolonged twenty-three days, the villous coat of the stomach and gullet was either softened or entirely detached. The muscular coat was exposed in several places, and was thickened, softened, injected, and inflamed. This acid has not so corrosive an action on the coats of the stomach as the strong mineral acids, as it rarely entirely perforates these coats, although it softens them and destroys their physical as well as vital cohesion. In some instances the inner surface of the trachea has been found inflamed, owing to its anatomical connexion with the œsophagus. In a few cases the lesions have been very slight, although the symptoms were severe; but little beyond softening of the coats of the stomach having been remarked.

165. *e. Death is the result* of the corrosive action of this acid upon the organization of the upper portions of the digestive canal, especially of the stomach, the nerves of the organ being more particularly affected. But the operation of this poison is thus limited only when large doses of it are taken, and then the local injury and disorganization and consequent vital shock are sufficient to destroy life. It has not been found to affect the larynx so as to threaten suffocation. When swallowed in smaller quantity, or in states of dilution, it is manifestly absorbed, and acts upon the nervous system and on the blood (§ 25, *et seq.*). Much of the change observed, both in the tissues of the stomach and in the blood, in cases of rapid poisoning by this substance, has arisen from the action of such portions of it as have still remained in, or been imbibed by the stomach at the time of death, the changes found on inspection having been partly thus produced *post-mortem*.

[Dr. C. T. Jackson has reported an interesting case of poisoning by oxalic acid, in the thirtieth volume of the Boston Med. and Surgical Journal, p. 17. A man, aged 30, took, February 1st, at half past eight A.M., about one third of a

tea-cupful, or about one ounce, of the crystallized oxalic acid, mistaking it for Epsom salts. He immediately perceived, by the strong acid taste, burning sensation in the throat, &c., that he had made a mistake, and he immediately drank a large quantity of warm water to excite vomiting, which produced the desired effect. He also took ipecacuanha by the advice of a physician. This was followed by antimony in emetic doses, and castor oil. When called at half past eight P.M., Dr. J. found him in a state of complete prostration; face, lips, throat, and tongue swollen and livid; pulse almost extinct, fluttering, and irregular; heart, in a continual fluttering palpitation; great jactitation and distress, with incessant vomiting. The matter evacuated by vomiting was a thick, grumous, and jelly-like fluid, of a yellow colour, mixed with white flocculi. He complained of no pain at the epigastrium, or over the bowels, on pressure, but the distress and anxiety were very great. The matter first brought up by vomiting was of a dark chocolate colour. Dr. J. ordered carb. lime, ʒiij., mixed with camphor and opium, five grains: this was given in divided doses, but rejected; an enema of soap and water was also given. February 2d, face tumid, and of a livid colour; tongue swollen and livid, pulse 130; urine entirely suppressed; gave an infusion of salts and senna; vomiting continued for two or three days, with great distress and anxiety; tongue became covered with a brown coat, with a red, dry tip; great thirst, no pain. The case was treated like one of gastritis, with general and local bleeding, morphia, &c. On the 6th, his mind began to wander, and petechiæ appeared on the face, head, chest, nates, &c., appearing as if sprinkled with blood. He continued to fail, and died on the 10th, ten days after taking the poison.

Post-mortem Examination.—Muscles rigidly contracted; numerous petechiæ; emphysema of lower lobe of left lung; unusual infiltration of serum in lungs; left side of heart empty of blood; the right contained a small quantity; gall-bladder distended with yellow bile; stomach contained a yellow fluid, evidently coloured with bile; stomach remarkably corrugated; mucous membrane very bright red, especially in small curvature of the organ and around the cardiac orifice; numerous small ulcers in the mucous membrane, which was much thickened and soft; the mucous surface of the duodenum was red, and also thickened, and studded with ulcers; also that of the jejunum and ilium congested; Peyer's glands not enlarged; small intestines contained soft, yellow, fluid fæcal matter; the large intestines contained scybalæ of fæcal matter; mucous membrane healthy; spleen natural; bladder contained some urine.]

166. *f. Treatment.*—The *antidotes* against this poison should be most promptly resorted to. The best are chalk, calcined magnesia, or the carbonate of magnesia. These should be abundantly mixed in water, or milk, or in any oleaginous or demulcent fluid instantly at hand. Lime-water and oil may also be given. As chalk is the best antidote, Dr. Christison advises that even the plaster of the apartment should be broken down in order to be given; but it would be difficult to reduce the plaster in a very short time to a powder sufficiently fine to admit of admixture, and of deglutition in the existing state of the patient. Free dilution—copious draughts of demulcents, emollient decoctions, &c., are generally of use; but they should be given in large quantities, and their rejection, by irritating the fauces, should be encouraged. If dilution be not free and frequent, it may be injurious, by dissolving the poison and by favouring its absorption. If vomiting can be produced after the antidotes and much fluid have been taken, it should be encouraged by means of oleaginous and emollient fluids; but recourse to the stomach-pump is of doubtful efficacy, as it may injure, or even perforate the softened coats of the œsophagus and stomach. When it can be easily introduced, and when there is little or no singultus, antidotes and demulcent fluids having been already freely swallowed, then it may be of use, if vomiting does not take place, for the removal of the contents of the stomach, and for the introduction of remedial agents when deglutition cannot be accomplished. But it should not be overlooked that the pharynx and gullet have sustained nearly as great an injury as the stomach, and that the too early use of this apparatus will prevent the antidotes and other medicinal substances which should be swallowed from exerting a salutary effect upon those parts. As the salts which the alkalies form with oxalic acid are as injurious as this acid itself, neither the alkalies nor their carbonates should be given after poisoning with it. The consecutive effects of this substance should be treated as those of other corrosive poisons, or as the operation of this acid requires when given in small or diluted doses, and when acting as will hereafter be shown. (See next Class.)

167. ii. Alkalies.—*Ammonia, potash, soda, and their carbonates—pearlash, soap-lees.—a.* The *vapour of strong ammonia* may rapidly destroy life, when *inhaled*, by producing acute inflammation of the larynx and trachea, often extending to the bronchi and lungs, and all the symptoms of violent croup. When ammonia is held too near the nostrils to rouse persons from syncope, its vapour may act more or less as an irritant of the respiratory mucous surfaces, and be injurious not only in this way, but also in as far as it prevents a due supply of air to the lungs.

168. *b. The symptoms occasioned by the fixed alkalies*, when taken in large quantities, are nearly the same as respects the caustic states of these alkalies; the subcarbonates and carbonates being more mild in their operation. Poisoning by these substances is generally caused by accident. When the caustic alkalies are swallowed, an acrid, corroding taste and pain, with a sensation of burning and excoriation, are felt in the mouth and throat; these latter sensations proceeding along the œsophagus to the stomach and epigastrium. Vomiting often occurs, and the matters thrown off usually consist of soft substances, resembling the softened, detached portions of the villous tissue, with mucus, often mixed with dark, discoloured blood, and with alimentary articles more or less altered, in the first instance. Both these and other associated symptoms vary with the concentration and quantity of the alkali; but vital depression soon appears. The mouth, tongue, and throat present a tumefied, soft, flabby, and inflamed appearance; the surface becomes cold and clammy; the pulse feeble,

small, and quick; singultus is often present; the pain extends to the central and lower regions of the abdomen, and diarrhœa supervenes and becomes urgent and exhausting. The symptoms are somewhat less severe when the carbonates have been taken, unless the dose of these has been very large and the solution very strong.

169. *c. Ammonia* and its sesquicarbonate produces nearly the same symptoms as the fixed alkalies; the chief differences being, that strong solutions of the former occasion a more violent burning pain in the fauces, œsophagus, and stomach than the latter, the larynx being oftener implicated. But poisoning by ammonia is not common, cases of it occurring chiefly by mistake, which is most frequently discovered before much of it is swallowed; and then the fauces, pharynx, larynx, and œsophagus are severally more or less affected, according to the strength of the solution. Ammonia is not so productive of vomiting as the fixed alkalies, when taken in poisonous doses, the symptoms being more closely allied to those of gastritis, associated with enteritis and œsophagitis; and it seldom occasions diarrhœa. In the more concentrated states ammonia also occasions singultus and convulsions.

170. *d.* The *quantity* required of these substances to produce death necessarily varies with the concentration of the solution, and with the state of the stomach as respects the quantity of aliments in it, and other circumstances. The caustic alkalies are fatal in smaller quantity and in less time than the carbonates and the preparations of ammonia. Orfila adduces two instances in which half an ounce of the carbonate of potash was fatal, the patients having lingered for several months. The exact quantity, however, cannot be assigned; for a comparatively small one, if the alkali be caustic, or if it implicate the larynx, may be rapidly fatal.

171. *e.* The *duration* of the symptoms, or period which usually elapses until death occurs, may be very short, especially as respects the caustic alkalies. Mr. Taylor estimates the shortest period at three hours; and in this case death was caused by three ounces of a strong solution of the carbonate of potash. When the substance attacks the larynx, as often occurs in respect of the mineral acids, this period will also be short. The more immediate effects of the caustic alkalies usually terminate fatally in two or three days; the softening and disorganization of the villous surface of the digestive canal, and the arrest of circulation in the vessels supplying this canal, terminating life in a very few days, and even in a shorter time, if the extent of injury be such as to occasion severe vital shocks in addition. When the injury is less, or the vital resistance to it greater, the patient may linger for weeks, or even months; the solution, abrasion, or excoriation of the villous surface of the stomach, and of other parts of the canal, being attended by pain and tenderness in the hypochondria and other regions of the abdomen, with vomitings, anorexia, indigestion, diarrhœa, and often, also, with difficult or nearly impossible deglutition. Owing to the injury or destruction of the digestive villous surface, digestion and assimilation are impaired or arrested, and the patient sinks from the inanition thus occasioned by the local injury; whatever amount of absorption of the poison may have taken place into the circulation, in cases where the substance has been more diluted, and the local injury less, acting a very subordinate part in producing the ultimate result.

172. *f.* The *appearances after death* consist chiefly of a diffluent softening, abrasion, or detachment of large portions of the villous surface of the fauces, pharynx, œsophagus, and stomach; and sometimes also of parts of the duodenum and intestines. The internal surface of the canal, especially of the stomach, presents a chocolate colour; and the contents are fluid, viscid, and often dark from the admixture of exuded blood. The softening of the coats of the stomach sometimes extends to all the coats, but especially to the more internal; and much resembles the gelatinous softening met with in the stomach in rare instances, and attributed to the action of the gastric juices after death (sec § 84–87); but there have been more tumefaction and darker discoloration in the poisoning now being considered. When death has been produced by ammonia or its sesquicarbonate, the softening and tumefaction have been attended by signs of inflammation and excoriation, inflammatory appearances existing also in the trachea and larynx.

173. *g.* Of the *action* of the alkalies and their carbonates it may be concluded that, in their concentrated states, in large quantities they are fatal chiefly by their local action, in the way stated above (§ 171, 172); and that, in weaker forms or in small doses, they are more or less absorbed, as demonstrated by the composition of the urine and other secretions; but they are generally eliminated by the emunctories before they accumulate in the blood to a very injurious amount.*

174. *h. The treatment of the alkaline poisons* consists in the immediate exhibition of fluids containing vinegar, or any of the vegetable acids which may be obtained with the least delay. If any of these be not quite at hand, draughts of beer or of malt liquors; or demulcents with oil, or milk, gruel, &c., may be taken until these acids are procured. A tepid infusion of chamomile flowers is afterward of use in promoting vomiting, and it may be given with or without moderate doses of the sulphate of zinc. The stomach-pump may be more injurious than beneficial, especially if the caustic fixed alkalies have been taken, for the tumefaction and softening of the coats of the œsophagus and stomach are often so great as to render it difficult to introduce the tube without causing laceration or injury.

The *treatment* of the secondary effects of these poisons consists chiefly in removing the effects which may be inferred from the symptoms still to continue. At first demulcents, oleaginous and emollient substances, may be administered, and afterward gelatinous and far-

* *When injected into the veins*, Orfila believed that the alkalies caused death by coagulating the blood. I find it remarked in my note-book, when detailing some experiments with the alkalies, in which I was concerned in 1820, that "the alkalies and their carbonates, when injected into the veins, appear to destroy life by impairing organic nervous energy, the irritability of the heart, and the functions of the brain, and by their influence on the nervous masses and structures while circulating in the blood-vessels and capillaries."

inaceous articles of food in small quantities may be given. An attempt may be made, with caution, to restore the tone of the villous surface, by giving small doses of *creasote* with demulcents, or of the pyroligneous acetic acid, or the compound infusion of roses with small doses of quinine, or of the sulphate of zinc, or such of the tonic and astringent infusions or decoctions as may be found to agree the best with the stomach. When the difficulty of swallowing and continued irritability of the stomach excite fears of abrasions of the villous coat of the digestive canal, and if diarrhœa warrant the supposition that this lesion extends as low as portions of the intestinal tube, then astringents and tonics, vegetable or mineral, as either appears most appropriate, should be given in small but frequent doses, with small quantities of opium, in demulcent and emollient vehicles. By attempting to support vital power by suitable means, and to restore the tone of those parts of the villous surface which have been the least injured, nature will thereby be the better able to reproduce in some measure the abraded portions, or in some way to supply their functions. In other respects the treatment, the diet, and the regimen should be adapted to the features of particular cases, with a careful observation of the *juvantia* and *lædentia*.

175. iii. Antimony—Chloride of.—*Butter of Antimony.*—This is the only preparation of antimony which I shall notice as a *corrosive poison;* the other preparations of this metal being more or less absorbed, and acting otherwise on the system. The *chloride*, as usually employed, is a very corrosive liquid, varying in colour, according to the quantity of iron it contains, from a light yellow to a dark red. Poisoning rarely occurs from it. Mr. Taylor, however, refers to three cases which have been recently recorded: two were caused by mistake, one intentionally; and in this last between two and three ounces of this solution were swallowed.

176. *a.* The *Symptoms* were in many respects the same as those described above as being caused by the caustic alkalies: a burning pain in the throat, course of the œsophagus, and stomach; constant efforts to vomit; collapse of the features, coldness of the surface and extremities, and faintness; a small, weak, and frequent pulse; pains in the abdomen, with tenesmus, but no evacuations. To these succeeded drowsiness, convulsions, and, in the suicidal case, death in ten and a half hours. The two accidental cases recovered, much smaller quantities of the poison having been taken.

177. *b. On inspection after death*, the fatal case presented the internal surface of the digestive canal, from the mouth to the jejunum, of a black and charred appearance. The mucous membrane was destroyed throughout this extent: "there was none of this membrane, in general, remaining, only a flocculent substance, which could be easily scraped off with the back of the scalpel." The subjacent coats were so soft as to be torn with the greatest ease.

178. *c.* The *treatment* should consist chiefly of copious draughts of water, or emollients and demulcents containing sugar, and, after free vomiting has been procured, with opium or sirup of poppies. If vomiting does not immediately follow the ingestion of this poison, Orfila recommends that a decoction of cinchona, or of willow or oak bark, or of powdered gall-nuts, should be freely taken as soon as possible. The treatment of this poison does not differ from that advised for the fixed alkalies as respects either these substances or those mentioned under that head. *See, also, the preparations of antimony* in Class v.—Acro-sedative Poisons.

179. iv. Iodine and Bromine.—*A. a. Iodine* acts differently on the economy, according to the concentration of the tincture or solution of it which may be used. In a state of strong spirituous or ethereal solution it acts as a powerful corrosive of the tissues to which it may be applied; but in weaker solutions, and in various states of combination, it is much less corrosive, or is merely an irritant, and is more or less copiously absorbed into the circulation. In these states it acts as an irritant and alterative, or *acro-alterative poison*, in which class I have considered it and its preparations.

180. *b.* The *fumes of iodine*, when inhaled, produce a violently irritating effect upon the respiratory passages, especially the larynx and trachea. If the vapour is concentrated, it occasions constrictive irritation and inflammation of these parts, which may be followed by asphyxia. In milder states it occasions inflammation of the air-passages, with or without pneumonia. I have seen more than one case in which the vapour of iodine had been resorted to in the treatment of pulmonary consumption, with the effect of producing dangerous bronchitis, owing to the strength of the vapour which had been inhaled.

181. *c. Applied externally*, iodine, in a concentrated or pure state, or in that of a strong tincture, acts as a caustic, and changes the cuticle to an orange-yellow colour, causing desquamation, and, if allowed to remain, inflammation and destruction of the tissue with which it comes in contact. In weaker states of solution it acts as a desiccant of secreting or mucous surfaces, and inflames them more or less intensely. Hence, if injected, even in these states, into mucous canals, or taken into the stomach, it would act as an acrid corrosive poison.

182. *d. When iodine is swallowed* in a more or less pure or concentrated form, it produces the most violent sufferings, especially if the quantity be large; but the effects vary remarkably with the state and contents of the stomach at the time of its ingestion; for if this viscus contain much bread, potatoes, or farinaceous or amylaceous articles of food, the iodine will be thereby rendered much milder in action by forming an iodide of starch, as Dr. Pereira has remarked. Spirituous solutions of iodine, or the iodureted solutions of the iodide of potassium, when swallowed in more or less strong or concentrated forms, cause a most acrid sensation, with constriction, burning pain, and dryness of the throat, descending down the œsophagus to the stomach, where they produce lacerating pains and efforts to vomit, extreme thirst, tenderness of the epigastrium, with anxiety, tremours, loss of strength, palpitations, faintness, sinking of the pulse, suffusion of the eyes, and restlessness. Dr. Jahn mentions a case in which an over-dose occa-

sioned violent pain in the abdomen, vomiting, profuse bloody diarrhœa, coldness and blanching of the skin, rigours, rapid pulse, &c. In a case noticed by Dr. Christison, a drachm and a half of the iodureted solution of the iodide of potassium produced acute pain and burning in the pit of the stomach, nausea, followed by vomiting of yellowish matters, which had the taste of iodine; by restlessness, headache, giddiness, and pallor of the countenance; and by recovery after five days. In a fatal case recorded by Zink (*Journ. Comp.*, t. xviii., p. 126), the symptoms were restlessness, burning heat and dryness felt from the throat along the course of the œsophagus to the stomach, unquenchable thirst, palpitations, and a frequent, unequal, and weak pulse, violent priapism, copious diarrhœa, parched tongue, tremours, and faintness. The patient was bled; the blood was cupped and buffed. He died after five weeks. In another case, in which the tincture of iodine caused slow poisoning and death, M. Zink found the following lesions:

183. *e. Appearances after Death.*—The intestines were distended with gases; effusion had taken place into the peritoneum; and adhesions had formed between several of the viscera. The gullet was much reddened internally, and remarkably constricted. The stomach was distended, and was externally inflamed in patches, and in one place apparently excoriated. It was inflamed internally, and corroded to a great extent near to the pylorus; the peritoneum covering the corroded part was detached and perforated with numerous small holes. The intestines were reddened and inflamed in places with patches approaching to sphacelation. The liver was enlarged, and of pale red or rose colour. The gall-bladder contained a large biliary calculus. The spleen seemed inflamed in some places. The pleura contained some serum.

184. *f.* The *quantity* of this poison required to destroy life depends upon the concentration of the solution employed, and the nature and quantity of the aliments in the stomach. When the iodine is pure or in large quantity, in whatever state it may be employed, it acts as a corrosive or caustic poison, causing death by its local action. In states of weaker solution, or in combinations which weaken its action, or in small doses often repeated, it produces *slow poisoning*, as will be shown hereafter. It is then absorbed, and it accumulates in the system, producing emaciation and various morbid changes. The quantity required or the time taken to produce death has rarely been remarked in respect of this poison. Dr. Gardner states that a scruple of pure iodine, in the form of tincture, destroyed a child four years of age in a few hours.

185. *g.* The *treatment* of the more corrosive states in which iodine may be given is not satisfactory. The stomach-pump should be early employed, and vomiting encouraged by giving fluids containing amylaceous and farinaceous substances. Starch enemata should also be thrown up, and demulcents taken frequently. [Irritation should be relieved by opiates.] In other respects the treatment should be the same as recommended for *gastritis*.

186. *B.* Bromine is but little known as a poison. Its vapour is most irritating when brought in contact with the conjunctiva.—*a.* When its vapour is *inhaled*, violent cough, a feeling of suffocation, with dryness and constriction of the larynx, are occasioned, and are soon followed either by inflammation of the respiratory passages, or by asphyxia. Franz had violent cough and sense of suffocation, followed by headache, instantly after momentarily breathing the vapour of bromine.

187. *b.* When a *watery solution is injected into the veins*, according to the experiments of Franz, Barthez, Dieffenbach, and Butzke, it appears to coagulate the blood, and causes immediate death, preceded by convulsions.

188. *c. Taken into the stomach*, it is a more corrosive poison even than iodine. Butzke, after swallowing a drop and a half of this substance in half an ounce of water, felt heat in the mouth, œsophagus, and stomach, followed by colicky pains. Two drops occasioned nausea, hiccough, and increased secretion of mucus. (*See* Christison on Poisons, p. 1–5, and Pereira's *Mat. Med.*, vol. i., p. 250.) From these experiments it is evident that bromine acts in a similar way to iodine in every respect; but that it is poisonous in smaller quantities than iodine, although the *symptoms* and changes produced by it in the digestive canal are the same as those occasioned by that substance. The *treatment* is the same for both poisons.

189. v. Lime acts as a corrosive poison when taken into the stomach, or applied to a vital part, in its caustic and unslacked state; but it is rarely so employed, even accidentally; two cases of this kind only being noticed by medico-legal writers. It is evident, from its caustic action, that the ingestion of it, or its introduction into mucous canals, will be followed by corrosion, and inflammation of the tissues with which it comes in contact. When employed in its quick state, it will even decompose or destroy the structures by imbibing their watery or fluid constituents.

190. *a.* When *swallowed*, it occasions heat, constriction, and pain in the throat, descending to the stomach, with unquenchable thirst, nausea, retchings, severe colicky pains, constipation, and the usual symptoms of corrosive poisoning, followed by nearly the same *changes* as have been already described, especially inflammation and corrosion of the parts with which it had come in contact.

191. *b.* The *treatment* should be the same, as respects *antidotes*, as that advised for poisoning by the fixed alkalies (§ 174), especially an immediate recourse to vinegar, lemon-juice, or any vegetable acid, and to demulcent drinks. Subsequently, if symptoms of gastritis, or gastro-enteritis are developed, vascular depletions, and the usual treatment of these diseases, should be prescribed.

192. vi. Phosphorus, when minutely divided, proves a violent corrosive poison. According to the experiments of Magendie and Orfila, when it is dissolved in oil and *injected into the veins*, it occasions almost instantaneous inflammation of the bronchi and substance of the lungs.

193. *a.* It may be *taken into the stomach* either as an empirical remedy or accidentally; but its effects on man have not been often observed. It was at one time much employed, in small doses, in medical practice, especially as an aphrodisiac, and it probably occasioned dangerous

symptoms even when thus prescribed. It is generally *slow* in its operation, although it is poisonous in very small quantities, particularly when melted in warm water or in oil. The most rapidly fatal case I find noticed is that by Dr. Flachsland. A young man took, at the recommendation of a quack, some of this substance on bread and butter, to cure general debility, constipation, and impotence. He was immediately seized with violent pain in the stomach, continual retchings, discharges after injections that shone in the dark; and he died in forty hours. The quantity of phosphorus taken was not known. Dr. Christison states, that a grain and a half proved fatal in a case which was mentioned by M. Worbe. A stout young man, having taken half a grain without injury, took a grain and a half in hot water. Seven hours afterward he was attacked with pain in the stomach and bowels, with incessant vomiting and diarrhœa, excessive tenderness and tension of the belly, and died exhausted in twelve days. M. Julia-Fontenelle relates the case of an apothecary who, after taking in one day first one grain of phosphorus, and then two grains, without experiencing any effects, swallowed next day three grains at once in sirup. In the evening he felt generally uneasy from a sense of pressure and constriction in the abdomen, which continued for three days, when he was seized with violent and continual vomiting of matters which had an alliaceous odour. On the seventh day, spasms, delirium, and palsy of the left hand supervened, and death speedily ensued. It is manifest that, if applied to wounds, or introduced into any of the natural canals, the effects would be very violent, and even fatal after a longer or shorter period.

194. *b.* The *morbid appearances* after poisoning with this substance have been recorded only in the cases observed by Worbe and Flachsland (§ 193). In the case of the former, where only one grain and a half of this poison was taken, the skin was generally yellow, and livid in places. The lungs were gorged with blood. The muscular coat of the stomach was inflamed. The other coats near the two extremities of the organ were black. In Dr. Flachsland's case, much fluid blood was discharged on making the first incisions. The omentum and external surfaces of the stomach and intestines were red. The villous coat of the stomach presented an appearance of gangrenous inflammation, which Dr. Christison suggests to have been black extravasation only; and the duodenum was similarly affected. The large intestines were contracted to the size of the little finger, and the mesenteric glands were enlarged. The kidneys and spleen were inflamed.

195. *c. Treatment.*—Large quantities of demulcent liquids should be exhibited, and magnesia given to neutralize any phosphorous and phosphoric acids which may be formed. Vomitings should be early encouraged by large mucilaginous draughts; and inflammation allayed by general and local depletions, or the latter only, or both, according to the peculiarities of the case. Dr. Pereira advises parts burned with phosphorus to be washed with a weak alkaline solution, to remove any phosphorous acid which may perpetuate the irritation.

196. vii. Salts, Corrosive Alkaline.—*Saline Caustics.*—Of the *alkaline salts*, the most *corrosive* are the *bichromate of potash* and the *binoxalate of potash.* Several other alkaline salts, which have usually been arranged with corrosive poisons, exert their fatal influences otherwise than by any corrosive effect they produce on the digestive canal; this effect never amounting to more than irritation and inflammation, which are of themselves insufficient to cause death in the short period sometimes observed.

197. *A.* The *bichromate of potash* is extensively used in dyeing. Accidents may hence occur from it, although it may not be resorted to with suicidal or criminal intentions. In a case in which a strong solution of it was taken, burning pain in the throat, violent vomiting, and the other symptoms of corrosive poisoning, and death in five hours, were occasioned. On *examination* after death, extensive destruction of the mucous membrane of the stomach and small intestine was found. Dr. Christison remarks that, when this salt was first introduced into the art of dyeing, the workmen, who had their hands frequently immersed in its solution, were attacked with obstinate ulcers in the parts touched by it, and that these sores gradually extended deeper and deeper without spreading, until they actually sometimes made their way through the arm or hand.

198. *B.* The *binoxalate of potash*, when taken into the stomach, produces the same *symptoms* and *structural lesions* as have been described as the consequences of the ingestion of *oxalic acid;* and the treatment of instances of poisoning by the bichromate of potash, or by it, differs in no way from what has been advised for poisoning with that acid (§ 166).

199. viii. Salts—Metallic.—Several of these salts exert a corrosive action on the living tissues; and, when taken into the stomach, in states of strong solution or in substance, they destroy life chiefly in virtue of this action; but in smaller doses, and in weaker solutions, they act differently, are more or less abundantly absorbed, and produce effects which rank them under certain of the *classes* of poisons to be considered in the sequel. It is chiefly with reference to this corrosive and local action that I have here to notice them.

200. *A. Antimony.*—The several preparations of antimony liable to become poisonous, with the exception of the *chloride* (§ 175), act as irritant and depressing agents, and are therefore treated of in the Class *Acro-sedative poisons.*

201. *B.* Bismuth—*Subnitrate of—Magistery of Bismuth—Bismuthi trisnitras.*—Poisoning by this substance has rarely occurred. In the experiments of Orfila, forty grains of the *nitrate of bismuth* introduced into the stomach of a dog produced all the symptoms of corrosive poisoning, and death in twenty-four hours; the villous coat of the stomach being reduced to a pulpy mass, and eroded in parts. The *subnitrate* was found to produce the same symptoms and lesions as the nitrate, but a much larger dose was required.

202. *a.* In a case in which the *trisnitrate* was taken, in the dose of two drachms, the patient was immediately attacked with burning pain in the throat, vomiting of brown matters, purging of watery stools, cramps, and coldness of the limbs, intermitting pulse; followed by inflammation of the throat, difficult deglutition, a constant nauseous metallic taste, hiccough, labori-

ous breathing, suppression of urine, swelling, and tension of the belly, salivation, delirium, &c. He died on the ninth day.

203. *b.* On *inspection* it was found that, from the pharynx to the rectum, there were but few points of the digestive canal free from change. The tonsils, uvula, pharynx, and epiglottis were gangrenous, the larynx spotted black, the gullet livid, the stomach very red, with numerous purple pimples; and the whole intestinal canal was red and gangrenous in places, especially at the rectum. The endocardium was bright red. Probably in this case there was partial absorption of the salt, which had thus inflamed the endocardium; if, indeed, the redness was not merely the result of *post-mortem* coloration.

204. *c. Treatment.*—No chemical *antidote* is known to this poison. Emollient drinks should be given abundantly, and the poison evacuated from the stomach as speedily as possible by means of the stomach-pump, or otherwise. Afterward demulcent enemata ought to be administered. A strictly antiphlogistic treatment should be adopted, to prevent inflammation, or to remove it if it have supervened. Opiates in full doses, camphor, and demulcents should also be exhibited.

205. *C.* Copper—*The preparations and compounds of*, are violent poisons; but, although they produce an active emetic effect when taken into the stomach, they act in large doses more upon the nervous system than locally, or as corrosive or caustic agents. These preparations have seldom been given with a criminal intention, owing to their acrid taste, unless with the view of producing abortion, and with this object the *sulphate* has been often taken. Poisoning by them is most frequently the result of accident. When swallowed in the largest quantities they sometimes occasion the least serious effects, owing to their instant rejection by vomiting. They, nevertheless, often produce, either most *acute* and virulent poisoning, or effects which are more slowly developed, thereby occasioning a *chronic* form of poisoning. Even in the most acute or rapid cases, the lesions they produce on the digestive canal may be the least remarkable, while in the slow or chronic form these lesions may be severe.

206. *a.* The *symptoms*, as respects the digestive organs, are nearly the same as in other instances of corrosive poisoning; but the vomiting is most rapid and copious, and the rejected matters present a remarkably *blue* or *green colour*, sometimes with minute or broken crystals of the salt. Abdominal pain is acute, and is attended by diarrhœa, extreme anxiety, and spasms of the extremities. *Jaundice* is sometimes met with: a symptom rarely observed in other cases of acute or corrosive poisoning. Stupor, coma, insensibility, convulsions, and sometimes paralysis, supervene early, and terminate life in periods varying from three or four hours to several days. In the more *chronic* states, these symptoms are developed and proceed more slowly; the discharges present a greenish hue, especially if verdigris have been taken, and the salt may be detected in them. The digestive canal evinces the most severe disorder: vomiting, coppery eructations, salivation, diarrhœa, tenesmus, dysuria or suppression of urine, cramps, convulsions, prostration of strength, &c., continuing for several days, or until death or recovery takes place.

207. *b.* On *dissection*, of the chronic cases especially, evidences of inflammation, in various parts of the digestive canal, have been found, generally attended by softening, tumefaction, ulceration, and more rarely with perforation of all the coats of the tube. These lesions are often more remarkable in the intestines than in the stomach. The digestive villous membrane presents a green colour, or even minute particles of the poison. These lesions are not constant; but the nervous system betrays, in the great majority of instances, marked functional disorder. Therefore, poisoning with the salts or oxides of copper will be further considered under the Class *Acro-sedative Poisons*.

208. *c. Treatment.*—The *chemical antidotes* for the cupreous preparations have been stated by Dr. Pereira to be the whites of eggs, given abundantly, or whatever may contain most *albumen*. In the absence of eggs, milk or wheaten flour should be employed. *Iron filings* have been proposed by Navier, Payen, and Chevalier, and subsequently by Dumas and Edwards; the iron decomposing the cupreous salt, and precipitating the copper in the metallic and inert state. The *ferrocyanide of potassium* is also said to be a good antidote; a drachm or two of it may be taken with safety. *Sugar* was proposed by M. Duval: its efficacy, although denied by Orfila and Vogel, has been recently contended for by Postel. (Pereira, *Mat. Med.*, vol. i., p. 776.)

209. The efforts of the stomach should, however, be promoted in order to procure the discharge of the poison; and, with this view, the whites of raw eggs, milk, warm mucilaginous drinks, &c., should be given frequently and liberally, and, as well as starch, administered as enemata. The stomach-pump may be of service in some instances; but, when vomiting follows freely and abundantly the ingestion of these draughts, it may be more injurious than beneficial. Inflammatory symptoms should be combated in the usual way, according to their severity and the peculiarities of the case. The nervous symptoms require a recourse to external derivatives, and the other means which will be mentioned in the sequel. (*See* Class *Acro-sedatives*.)

210. *d.* In the more *chronic* cases of poisoning with the cupreous compounds, opiates in full doses, with or without creasote and camphor, may be given in demulcent vehicles; or the sirup of poppies may be similarly exhibited or administered in enemata, and be aided by warm baths and external derivatives; but these means should not be resorted to until the poison has been evacuated from the stomach and bowels.

211. *D.* Gold—*Hydrochlorate of—Chloride of—Iodide of Gold*, and some other preparations of this metal, have been recently employed in medicine, especially on the Continent, and may, from accident or otherwise, occasion poisoning.—*a.* Dr. Christison states that the poisonous properties of the *chloride* are powerful, and closely allied to those of the hydrochlorates of tin and nitrate of silver. The chloride of gold occasions death in three or four minutes when *injected into the veins*, even in

very minute quantities, and the lungs are found after death so gorged with blood as to sink in water. (Orfila, *Toxicol. Génér*, t. i, p. 593.)

212. *b.* If the chloride of gold be *swallowed*, corrosion of the digestive canal takes place; and the salt is so rapidly decomposed that none is taken up by the absorbents; and death ensues from the local injury solely. Even in doses so small as a tenth of a grain, it has caused much irritation of the stomach. The form of fulminating gold has produced alarming poisoning where it was used in medicine. Plenck says that it excites griping, diarrhœa, vomiting, convulsions, fainting, salivation, and sometimes even occasions death. Hoffmann repeatedly saw it prove fatal, the most prominent symptoms being vomiting, great anxiety, and fainting. In one of the cases the dose was only six grains.

213. *c. Treatment.*—The *antidotes* for the preparations of gold are the same as those found most successful for poisoning by corrosive sublimate, especially the whites of raw eggs, or *albumen*, large draughts of *milk*, &c. The gastro-enteric symptoms should be removed by vascular depletions, derivatives, emollient enemata, warm baths, opiates, &c.

214. *E.* Iron.—None of the preparations of iron fall under the class of corrosive or caustic poisons, unless the *tincture of the sesquichloride*, and it owes its injurious operation, when taken in large quantities, to the excess of acid, the *symptoms* and *lesions* produced by it being the same as those occasioned by *hydrochloric acid* (§ 150).

215. *F.* Mercury.—*The preparations* of this metal often cause poisoning, which may be either *acute* and *rapid*, or *chronic* or *slow*, according to the quantity taken, to the repetition of the doses, and to the modes of employing them. In large doses, the more active of these preparations act rapidly, and are corrosive and acute poisons; but, in small or repeated doses, their effects are chronic or slow, and they act as *acro-alterative poisons*, in which *class* I shall consider this mode of their operation, in connexion with that of some other preparations of mercury. It is thus chiefly the *acute* or *corrosive action* of these preparations which I have here to consider; the *chronic*, or consecutive effects, will fall under the class just referred to.

216. *a.* The *Bichloride of Mercury—Corrosive Sublimate.*—The poisonous operation of this substance has been ably investigated by Orfila, Christison, Pereira, Devergie, Beck, Taylor, and others. The *symptoms* caused by a large dose of the bichloride appear either immediately, or in a very few minutes after having been swallowed. A coppery or metallic taste is felt in the mouth; and if the poison be in a state of solution, sensations of remarkable acridity, burning constriction, and corrosion are felt in the mouth, fauces, and pharynx, descending to the stomach, where, in whatever state it may have been taken, pain is very soon occasioned by it; is increased on pressure, and is followed by nausea and vomiting, the matters thrown up consisting of the alimentary articles remaining in the stomach, and afterward of stringy masses of white mucus, streaked or mixed with blood. To these supervene difficult deglutition, the rejection of whatever is taken into the stomach; sometimes a sense of strangulation or suffocation; the extension of pain over the abdomen, and intolerance of pressure; violent purging, and lacerating pains of the bowels, followed by tenesmus and mucous and bloody stools; anxiety, restlessness, and short or laborious respiration; a quick, small, and contracted pulse; burning thirst, and a white, dry, constricted state of the tongue and mouth; anxious expression of countenance, at first with flushing, subsequently with collapse and twitchings of the muscles of the face; suppression of urine or dysuria; cold sweats, great debility and sinking; sometimes ptyalism; sinking and irregularity of the pulse; and coldness of the extremities. Death is often preceded by stupor, insensibility, convulsions, or twitchings of the limbs, or even by paraplegia.

217. Poisoning by this substance *differs* from that produced by *arsenic*: 1st. The well-marked taste, and the acridity and irritation of the throat and æsophagus, produced by the former, are much greater than by the latter; 2d. The symptoms are more violent and immediate upon the ingestion of this poison than after arsenic; 3d. The evacuations are oftener mixed with blood, and irritation of the urinary organs, or suppression of urine is more frequent than after poisoning with arsenic. The symptoms caused by corrosive sublimate resemble, in the most acute cases, and at the commencement, an attack of common *cholera*; subsequently, when the patient survives two or three days, they resemble those of *dysentery*, especially as respects the existence of tenesmus, and of mucous and bloody stools; and when ptyalism, or affection of the salivary glands, is not present.

218. *b. Appearances after Death*—These are confined chiefly to the digestive canal. The mucous membrane of the throat and œsophagus, and sometimes, also, of the mouth and fauces, is softened, and of a whitish or bluish gray colour; that of the œsophagus, especially near the cardia, is partially corroded. The villous surface of the stomach often presents a slate-gray or grayish tint, arising from the action of the poison, as supposed, upon this surface during life. Underneath, the tissues are more or less inflamed, sometimes in patches, and large black ecchymoses, or extravasations of blood, are often found underneath the villous membrane. In rarer cases this membrane is only simply inflamed. The coats of the stomach are corroded, discoloured more or less, and often softened so as not to admit of removal without laceration. Perforation, however, is very rare. Similar changes to the above are met with in the small intestines and in the large bowels, especially in the sigmoid flexure of the colon and rectum, but not to so great extent as in the stomach, although sloughing ulcers are more frequently met with in these latter situations. The colon is generally very much contracted. In cases which have not been very rapidly fatal, sloughing ulceration, dark discolouring of the ulcers or in their vicinity, and softening, are met with in several parts of the digestive canal. Various alterations of the urinary organs are occasionally observed; but these are neither constant nor uniform, with the exception of contraction of the urinary bladder, which is always observed. The epiglottis and trachea

are sometimes inflamed, and the endocardium often presents indications of inflammation. The coats of the stomach and intestines and the collatitious viscera often yield mercury on analysis. Poisoning by this substance does not delay the accession or progress of decomposition, as observed in respect of poisoning by arsenic.

219. *c. The quantity which may destroy life* varies greatly with the circumstances adduced above (§ 51, *et seq.*). The *smallest* quantity instanced by Mr. Taylor is *three grains*, this having been given to a child by mistake for calomel; but he believes that *two*, or not more than *three grains*, have proved fatal in an adult. If this quantity—even two grains—be taken at once on an empty stomach, I do not douht that it is capahle of producing a fatal result, if medical aid be not procured; but I state this chiefly from much experience of the medicinal exhibition and properties of this substance. When this poison has been taken on a full stomach, or when free vomiting has followed the ingestion of it, or when medical treatment was not long delayed, very large quantities have failed to produce death. A case is recorded by Dr. Booth (*Medical Gazette*, vol. xiv., p. 63), in which *an ounce* was taken, and, owing to these favourable circumstances, recovery was effected.

220. *d. The period at which death takes place* varies, in the *acute cases*, from two or three hours to five or six days. Mr. Illingworth (*Med. Gaz.*, vol. xxxi., p. 557) met with an instance of death from the sublimate in from two to three hours. Death from this substance in from ten to twenty-four hours is common; but life may be prolonged for several, or even many days, although the dose of the poison has been very large, when medical aid has been soon obtained. In these, the symptoms of *slow* or *chronic poisoning* have generally appeared; and the effects—ptyalism, diarrhœa, tenesmus, &c. —described in connexion with the *acro-alterative* action of this and other preparations of mercury, have usually been observed. *Acute* poisoning by this substance is the result of the chemical action, and the destruction of the tissues caused by the contact of it. The fatal issue is produced by the extent of lesion of the digestive canal, aided by the shock to vital power and nervous energy. Whatever absorption may occur in the circumstances more favorable to this mode of operation and in the more prolonged cases, will farther aid this issue, owing to the injurious influence which an excessive amount of the poison in the circulation will exert upon the heart and nervous masses.

221. *e. The treatment of acute poisoning* by corrosive sublimate consists of the *removal* of the poison, of the administration of *antidotes*, and the counteraction and removal of the effects produced.—(*a*) The *removal* of the poison from the stomach is best procured by the encouragement of vomiting by means of copious draughts of fluids, containing or consisting of the antidotes about to be noticed. Mr. Taylor states that, "if vomiting do not already exist, it must be promoted by the exhibition of emetics." But it may be urged against this advice, that the circumstances are rare which admit of emetics; for they may increase the mischief in the stomach, or otherwise complicate the case; or time may be lost in waiting for their operation, which may not soon take place, unless they are of an energetic kind. A recourse to the stomach-pump is liable to the objection already urged against it, in cases where the œsophagus and stomach are constricted, corroded, or softened by the poison (§ 174). Swayed by these considerations, I advise an immediate recourse to such draughts as are most likely to promote vomiting, and thereby the rejection of the poison, and to convey at the same time the *antidote* which may be obtained with the least delay.

222. (*b*) The *antidotes* are chiefly those which more or less efficiently decompose the corrosive sublimate: these are *albumen*, the *gluten* of wheat, *milk*, *iron filings*, and *meconic acid*.—*a. Albumen* appears to decompose the sublimate, so as to render it almost inert. Dr. Christison has adduced several cases proving the remarkable efficacy of this antidote. The celebrated Baron Thenard swallowed inadvertently a concentrated solution of corrosive sublimate; but by the immediate and abundant use of the whites of eggs, he suffered no material harm. Raw eggs—both the whites and the yolk—should be taken most abundantly, and ought not to be withheld, even although the poison has been taken for a considerable time; for this antidote is often efficacious notwithstanding, and is the one most to be depended upon. Peschier states that one egg is sufficient for every four grains of the poison; but no harm can result from taking many, as they will be thrown off by vomiting; indeed, they should be so given as to promote vomiting.

223. *β. Gluten* has also been recommended by Professor Taddei. It may be prepared by washing flour in a muslin bag, under a current of water; but it will be preferable, when albumen cannot be procurred, to mix flour in water, and give it in abundance: it will thus often promote vomiting (§ 221), and act as an antidote. *Milk*, in the absence of albumen or flour, may be likewise given, or *gum-water*, *linseed tea*, or sweetened water. *Iron filings* are stated to be useful, by reducing the sublimate to the metallic state. *Meconic acid* is also said to be an antidote, by forming an insoluble meconate of mercury. But, as Dr. Pereira justly remarks, a knowledge of this fact is of little practical value, since the acid is not generally procurable; and tincture of opium, which contains it, cannot safely be used in sufficient quantity; for Dr. Christison finds that five grains of corrosive sublimate require an infusion of thirty-three grains of opium to precipitate the whole of the mercury. Mr. Taylor states, that the *protochloride* of tin, in the proportion of one part to fifteen parts of water, has been recently proposed by M. Poumet as an antidote. But the efficacy of this substance has not been sufficiently tested in the human subject. These antidotes, even albumen, cannot be expected always to be successful. The sooner they are given the greater is the chance of success. Several instances, however, have been recorded of their failure, owing either to delay in their exhibition, or to the perfect solution and quantity of the poison, or to other circumstances of the case. Hence it will always be proper to exhibit the antidotes, as already advised (§ 222),

especially the eggs, in large number, and in the way most likely to promote vomiting.

224. (*c*) The *effects* produced by the poison, as far as these are indicated, should next attract the attention of the physician. These approach, in some cases, to the more common forms of gastro-enteritis, or of dysentery, or even of peritonitis; but the vascular action is generally less sthenic than in those, owing to the extent and severity of the injury sustained by the villous membrane and nerves of the digestive canal, and hence vascular depletions cannot be carried to the same extent as in these diseases. They are, however, generally required, most frequently locally by leeches, rarely by venæsection, or by both modes in the same case. Demulcents with opiates should be freely administered, and emollient and anodyne enemata be thrown up. Fomentations, rubefacient embrocations, &c., ought to be applied to the abdomen, and frequently renewed; and warm baths resorted to occasionally.

225. (*d*) The *diet*, as recovery advances, should consist chiefly of farinaceous articles, of light panada, gruel, demulcent drinks, milk, rice-milk, or creams, and broths made of the flesh of young animals; and flannels ought to be worn nearest the skin.

226. *f.* The *nitrates of mercury* are corrosive poisons. They are easily dissolved in water, especially if there be a little excess of acid present. Mr. Bigsley has recorded (*Med. Gaz.*, vol. vi., p. 329) the case of a boy who dissolved some mercury in a strong nitric acid, and swallowed about a teaspoonful of the solution. He was instantly seized with excruciating pain in the pharynx, œsophagus, and stomach; urgent anxiety, cold skin, small pulse, colic, and purging. He sank rapidly, and died in about two hours and a half. The fauces, œsophagus, and stomach were found, after death, corroded and inflamed. The *treatmcnt* is the same for poisoning by these salts as for that by corrosive sublimate. The diluted proto-chloride of tin is suggested as an antidote by Mr. Taylor.

227. *g. Bicyanide of mercury* is a most active corrosive poison. A person swallowed twenty-three grains of this substance, and was immediately attacked with all the symptoms characterizing the ingestion of corrosive sublimate; and, on *inspection* after death, the same lesions of the digestive canal were observed. The *treatment* is also the same as that already recommended for poisoning by the sublimate.

228. *h. White precipitate*—the ammonio-chloride of mercury; *red precipitate*—the red oxide of mercury; *turbith mineral*—the subsulphate of peroxide of mercury; *cinnabar* and *vermilion*—the persulphuret of mercury; and *calomel*—the chloride of mercury, are severally acrid poisons, in very large or repeated doses, and may even corrode the digestive canal; but their effects are uncertain as respects this mode of action, and therefore they will be more appropriately considered hereafter; when also poisoning by the external use of mercurial preparations, and by other modes of employing them, will be noticed.

229. *G.* Silver—*Nitrate of—Lunar caustic*—is a powerful corrosive poison, when employed in substance or in strong solutions. It rapidly combines with, and is ultimately decomposed by the tissues, the acid corroding them. It is, in these states, a local and disorganizing agent, and is not absorbed unless it be employed in small and frequent doses. There are very few cases of poisoning by it on record, and these have not been detailed with any precision.—*a.* The *symptoms* produced by this poison are most probably but little different from those caused by several other corrosive poisons; but, judging from its effects in large medicinal doses, diarrhœa is most probably not occasioned by it.

230. *b. Treatment.*—The *antidote* for nitrate of silver is common salt, which, acting upon the nitrate, forms nitrate of soda and chloride of silver, which is innocuous. The contents of the stomach should be removed, and the symptoms alleviated, by demulcents, opium, external derivatives, and local bleedings; by emollients containing salt, and by anodyne enemata.

231. *H.* Tin—*the Chlorides or Muriates of.*—A mixture of these is extensively used in the arts, and may hence produce accidental poisoning; but instances of such an occurrence are extremely rare. They appear to act as local corrosive poisons when taken in large quantity, and to occasion the usual symptoms of this class of poisons. They are decomposed by many organic substances, and then the *treatment* of poisoning by them should consist of the liberal and frequent ingestion of albumen, milk, and demulcents; and, after the stomach has been completely evacuated, of the administration of opium, emollient enemata, &c.

232. *I.* Zinc—*Chloride of.*—*a.* This substance, now employed as an antiseptic, when taken into the stomach, or applied to any living tissue, in states of strong solution, is a powerful caustic, or corrosive poison. It may be inferred to produce the usual *symptoms* of corrosive poisons, as I am not aware of an instance of poisoning having been caused by it; and its effects may be *treated* by the administration of the carbonate of soda, or any of the alkaline carbonates, with albumen, demulcents, and other means already recommended for caustic and corrosive poisons.

233. *b. Sulphate of Zinc—white vitriol*—has been considered as a corrosive poison; but its corrosive and local action is very rarely so great as to occasion death, even when given in very large quantity, for it is generally immediately thrown off the stomach, and occasions merely an irritant and astringent action; and, with reference to this action, it will be considered in the *third class* of poisons.

234. ix. Vegetable Acrids.—There are numerous vegetable productions which produce poisonous, or at least injurious effects, when taken into the stomach; or when applied externally, or otherwise employed. Many of these act chiefly locally, inflaming and corroding the tissues; while others produce less local irritation, but are absorbed to a greater or less extent, acting thus remotely and injuriously upon the nervous centres and on vital organs. Under this class, I shall very briefly notice such of the vegetable poisons as act chiefly on the digestive villous surface when swallowed, and locally as respects the parts to which they may be applied.

235. *a. Anemone nemorosa—A. pratensis—A. Pulsatilla*, and *A. sylvestris*, are severally very acrid poisons. Bulliard states that an old man with rheumatic gout applied the bruised root of *A. Pulsatilla* to the calf of his leg on going to bed; violent suffering, with sphacela

tion of the part, ensued. Animals have exhibited marks of intense inflammation of the stomach and rectum after having swallowed it. *A. nemorosa* is said to produce dysentery in sheep. The inhabitants of Kamtschatka make use of this plant to poison their arrows. Robert and Vauquelin extracted a fluid of an acrid taste and pungent odour from the flowers of the *A. pratensis*, which acted like a caustic on the tongue.

236. *b. Arum maculatum*—*Wake-robin*—*A. Dracunculus*, and other species of arum are acrid poisons in the recent state, and when not acted upon by heat. They occasion a burning pain and swelling in the throat; difficult and painful deglutition. Bulliard states that three children, who ate of the leaves of the *A. maculatum*, were thus affected, and experienced horrible convulsions. Two of the three died after some days. The *Calla palustris*, or *Water Arum*, excites a similar action to the above.

237. *c. Bryonia dioica*—*Bryony*.—The root of this plant occasions vomiting, violent pain, profuse alvine evacuations, and faintings. Pyl mentions a fatal case from taking two glasses of an infusion of the root to cure an ague. Tormina and purging soon supervened, and killed the patient. It occasions violent inflammation in the large and small intestines, and of the stomach. Brandes imputes the acrimony of the plant to a principle which he has called *bryonine*, which induces intense inflammation of the parts to which it is applied.

238. *d. Caltha palustris*—*Marsh Marygold*—has been noticed by several writers as an acrid poison, inflaming the œsophagus, stomach, and bowels, even of the lower animals. A family of five persons in Germany, after partaking of it, were all seized, in half an hour, with pain in the stomach, sickness, vomiting, diarrhœa, and dysuria; and, on the following day, with a general swelling of the body, and a copious eruption. They, however, all recovered. In addition to the inflammatory action produced by it in the digestive canal, it appears to be absorbed, and to occasion general vascular excitement, and irritation of the urinary organs and skin.

239. *e. Chelidonium majus*—*Celandine*—has a bitter and acrid taste, and causes inflammation of whatever parts to which it may be applied. When taken into the stomach it inflames the digestive mucous surface, and is partially absorbed; exciting the brain and nervous system; and causing congestion of the lungs. These latter effects, especially that on the brain, are more remarkably produced by *C. Glaucium*. *Clematis Vitalba* (*Virgin's bower*)—*C. Flammula*—*C. erecta*—*C. integrifolia*, are all acrid and caustic. When applied to the skin, they produce redness, pustules, and excoriations. Stoerck and Mueller prescribed them in some chronic affections, especially syphilis, rheumatism, and scrofula, in small doses, in the form of infusion; continuing their use for some weeks with alleged benefit. M. Roques states that they occasion dysentery in animals. The powder of the leaves, in doses of one, two, or three grains, has also been employed. They are exciting, diaphoretic, and alterative in small doses; but in large doses they destroy life, by the intense inflammation they produce in the whole course of the digestive canal.

240. *f. Croton Tiglium*—*Purging Croton*.—The seeds of this plant have a burning, acrid, and nauseous taste. They were formerly employed as a hydragogue-purgative; but, on account of the violence of their operation, were laid aside. One seed is sufficient for a dose, and even sometimes excites violent vomiting and purging. More recently the *expressed oil* of this plant has come into use. Dr. Pereira met with a case of poisoning by inhalation of the dust of the seeds. The patient had been employed for several hours in emptying packages of the seeds. He complained of loss of appetite, of a burning sensation in the nose and mouth, followed by pain at the epigastrium, and copious lachrymation. He became giddy and insensible, but recovered. His bowels were not affected.

241. The oil causes rubefaction, and a vesicular or pustular eruption, when rubbed on the skin; and when rubbed on the abdomen, it often purges. When swallowed in one or two drops, it produces a burning acrid taste in the mouth and throat, and acts as a drastic purge, procuring watery motions, and sometimes an increased secretion of urine. It appears to be partially absorbed; but it evidently acts as a sedative irritant of the digestive mucous surface. The only case of poisoning which is known to have been caused by it was that of a young man, ill of typhoid fever, who took by mistake two and a half drachms of the oil. Three quarters of an hour afterward the skin was cold, and covered with a cold sweat; the action of the heart and pulse was scarcely perceptible; the respiration difficult, and the extremities blue. An hour and a half afterward there were excessive involuntary alvine evacuations, but no vomiting; the abdomen was tender to the touch; and a burning sensation was felt in the œsophagus. The blueness extended over the body; the surface became insensible, and death took place after four hours. This oil, even in the usual purging dose, sometimes acts violently, generally speedily, although not certainly, occasioning much depression of the vascular system, and a feeling of debility.

242. *g. Cucumis Colocynthis*—*Bitter Apple*.—The spongy or medullary part of the fruit is a drastic cathartic, causing inflammation of the villous surface of the bowels, and bloody evacuations. This substance has caused death in several instances owing to mistake. A woman swallowed a teaspoonful and a half of colocynth powder, and died in twenty-four hours. A person took two glasses of a decoction of colocynth, and died in a short time. Vauquelin discovered the active principle of this plant, and called it *colocynthin*.

243. The *symptoms* are, at first, frequent alvine evacuations; great heat and colicky pains in the bowels; dryness of the throat, and unquenchable thirst; a small and rapid pulse; redness of the tongue; a fixed pain around the umbilicus, and tenderness. To these succeed coldness of the extremities, cramps, sinking of the powers of life, and death. On *dissection*, the whole digestive canal exhibits marks of inflammation, which is often most intense in the stomach and large bowels, the villous membrane of which is abraded, readily detached, or even ulcerated. The intestines are studded with black spots or ecchymoses; the inflam-

mation sometimes extends through all the coats; the peritoneum being inflamed, and either adherent to its opposite surfaces, or covered by a false membrane, or containing a whitish fluid and florenti.

244. *h. Cyclamen Europæum* is a violent irritant, exciting vomiting and purging. Bulliard states that its root produces cold sweats, dizziness, and convulsions; the patient voids blood both by vomiting and by stool, the super-purgation and inflammation proving even fatal.

245, *i. Daphne Gnidium* (*Spurge-flax—Flax-leaved Daphne*)—*D. Mezercum*(*Mezereon*).—The bark of these plants acts as a corrosive poison when applied to living tissues. I have frequently employed the mezereon bark as an external irritant, instead of caustic alkali, in forming an issue. When swallowed, it inflames the digestive canal, causing heat and dryness of the throat; salivation, abdominal pains, frequent vomitings, bloody stools, giddiness, and feebleness of the limbs; and the lesions above described (§ 243). The *Daphne Laureola* is also poisonous, and produces nearly the same effects as the other species.

246. *k. Delphinium Staphisagria—Stavesacre—Palmated Larkspur—D. tricorne.*—The acrid property of these plants is lodged in the alkaloid, which Lassaigne and Feneulle discovered in them, and which is an extremely acrid irritant. The local effects of these plants are evidently the most striking. They have been found to inflame intensely the digestive mucous surface when swallowed, but not to produce any alteration of other organs.

247. *l. Euphorbia Officinarum.*—The stalk of the various species of the genus Euphorbia furnishes a milky juice, which, on being dried, is called *euphorbium*. It is a gum-resin, which contains an active principle, styled *euphorbin*. A teaspoonful of the gum-resin was administered by mistake; and it occasioned a burning sensation in the fauces and throat, rapidly extending to the stomach, and causing incessant watery vomitings. The pulse became remarkably rapid and irregular; a cold perspiration broke out, and death took place after two days. The body was inspected eight hours after death; the coats of the stomach could be torn with the greatest ease; the internal surface of the viscus was studded with gangrenous spots; the spleen was enlarged and much softened, and the inner coat of the aorta was beautifully injected with blood, and highly inflamed. The after lesion was probably caused by the partial absorption of the poison in this case.

248. Many of the *species* of the genus *Euphorbia* are poisonous, as the *antiquorum, canariensis, Tirucalli, Peplus, helioscopia, verrucosa, platyphyllos, palustris, hibernica, amygdaloides, sylvatica, exigua, mauritanica, neriifolia, Esula, heptagona*, &c, and have been employed in poisoning spears, arrows, &c. The species *Lathyris* and *Cyparissias* are said by Lamotte to have proved fatal when administered in a *glyster*. A person allowed his closed eyelids to be rubbed with the juice of the *E. Esula*: inflammation took place, and it was followed by the loss of the eye. A boy six years old ate some of the *E. Peplus*. It produced vomiting, purging, spasms, a weak, small pulse, inability to swallow, insensibility, cold extremities, and death. *On dissection*, the tonsils, fauces, and pharynx were seen very much inflamed. The villous membrane of the stomach and small intestines were very red; but that of the large intestines much less so. The urinary bladder was very contracted. The epiglottis and larynx were highly inflamed. The lungs were healthy. The veins of the dura mater were congested. The blood was fluid. The brain was healthy.

249. *m. Gratiola officinalis—Hedge Hyssop*—acts chiefly locally, causing inflammation of the part which it touches. It has produced death rapidly when an extract of it was injected into the veins.

250. *n. Hippomane Mancinella—Manchineel-tree.*—The wood of this tree, when green, excites inflammation of the skin when rubbed against it. The dust of the wood is so acrid as to excite inflammation of the respiratory passages, or asphyxia, when inhaled with the air. Dr. R. Madianna found that the juice excited inflammation when applied even to the sound skin. Orfila and Ollivier applied this juice to a wound in the cellular tissue with a fatal result. When given internally, it soon destroyed life; the stomach and intestines being found, on dissection, very highly inflamed.

251. *o. Jatropha Curcas—Indian Nut.*—The seeds of this plant are a violent poison, exciting incessant vomitings, purging, severe pain, vital depression, and death. Its fatal effects are more rapid when it is taken into the stomach than when introduced into the cellular tissue. When swallowed, it produces intense inflammation of the digestive canal. Mr. Bennett states that it is used as a purgative by the natives of the Philippine Islands, an over-dose producing intense pain, vomiting, and purging; their only antidote being large draughts of cold water.

252. *p. Juniperus Sabina—Savine.*—The leaves and tops of this plant contain an acrid poison, in the form of a volatile oil of a remarkable odour. They are acrid and irritant in the state either of infusion, powder, or tincture, and yield a light yellow oil, in which the active properties of the plant chiefly reside. The powder, or the infusion, or the oil has been often taken in excessive doses, in order to procure abortion, the power of accomplishing which effect it does not possess more than any other violent irritant. When employed with this intention, it not unfrequently destroys the life of the mother, and sometimes even before an abortion is procured. Mr. Taylor states that in a case in which the savine powder was taken with a fatal issue, he found a green fluid in the stomach, which, with the œsophagus and small intestines, was highly inflamed. The poison was identified by placing the minute portions of the leaves found in the stomach under a powerful microscope. A girl, to procure abortion, took a strong infusion of savine leaves, which produced violent pain in the abdomen and strangury. She miscarried two days afterward, and died four days after that. On *dissection*, extensive peritoneal inflammation was found. The inside of the stomach was very red, and checkered with patches of florid extravasation (Christison, *Op. Lat.*). While this substance acts locally, it is also partially absorbed, and, through the medium of the blood and urine, affects the urinary organs.

253. *q. Momordica Elaterium—Wild* or *Squirting Cucumber.*—The fecula deposited by the expressed juice of the fruit of this plant—*elaterium*—contains the active principle to which the properties of the plant are imputed, and are chiefly, if not altogether, owing. Drs. Clutterbuck, Paris, Morries, and Pereira have examined this fecula, and found that its active principle—*elaterin* or *momordicine*—which is soluble in alcohol, is a very active purgative in the dose of one twentieth of a grain. Elaterium—the fecula of the juice of the fruit—when of the best quality, is a drastic and hydragogue purgative in the dose of the one twelfth of a grain. Its acridity is such that it inflames and ulcerates the fingers of those who prepare it. Although acting thus energetically as a local irritant, it appears also to be partially absorbed, and even to have its irritant action transmitted by means of the nervous system to parts more or less remote. When taken in a large dose, it produces violent hypocatharsis and very copious watery stools, being the most energetic hydrogogue purgative known. Even a quarter of a grain of the purest kinds of elaterium may produce this effect and procure the discharge of several pints of fluid by the bowels. An over-dose occasions not merely violent griping pains in the abdomen, but also increased frequency of pulse, a dry tongue, great thirst, and dampness and coldness of the skin. A female took, by the advice of a quack, in divided doses, two grains and a half of elaterium and sixteen of rhubarb. They produced incessant vomiting and purging, which did not yield to treatment. She died in thirty-six hours. On *dissection*, the villous membrane of the stomach and intestines was intensely inflamed. The colon was contracted: the other viscera were healthy. (*Boston Med. Mag.*, vol. iii., p. 25.)

254. *r. Narcissus Pseudo-narcissus—Daffodil—Meadow Narcissus.*—The extract of this plant, applied either externally or internally, produces violent retchings, followed by death, owing to intense inflammation caused by it in the stomach and intestines, even extending to the rectum.

255. *s. Ranunculus.*—Several species of this genus of plants are remarkably acrid and corrosive, especially the *R. acris, R. sceleratus, R. Flammula, R. arvensis, R. bulbosus, R. alpestris, R. aquatilis*, &c. The leaves, flowers, and expressed juice irritate, inflame, and ulcerate the external surface, according to the duration of their application; and, when swallowed, they excoriate the tongue, mouth, and throat; corrode and inflame the stomach, and tumefy the œsophagus and pylorus, occasioning extreme pain, retchings, &c. (Plenck.)

256. *t. Rhus Toxicodendron—Poison Oak—Poison Ivy.*—Fontana, Alderson, Barton, Bigelow, and others, have noticed the intensely poisonous action of this and several other species of the genus *Rhus*. A small portion of the milky juice applied to the skin excites burning, swelling, inflammation, and small vesicles containing a sharp transparent humour; and nearly the same symptoms are produced by touching the leaves. Dr. Alderson states that sphacelation has followed contact with the acrid juice of this plant in some cases. Drs. Cutier and Bigelow mention various noxious effects to have followed the handling and the burning of the wood of the *Rhus vernix*, or *poison sumach*. The inflammation produced by the several poisonous species of this genus appears to present peculiar characters, with a marked disposition to diffusion, tumefaction, and gangrene, or to assume the form I have described when treating of *diffusive inflammation of the* Cellular Tissue. The leaves and juices of these species have been employed in medicine as excitants, and are supposed to produce not only intense irritation, but also considerable stupefaction; and hence it may also be considered as a powerful *acro-narcotic poison.* (See Class VIII.)

[Poisoning by the *Rhus vernix* is very common in the United States, and may occur from touching or smelling any part of the plant, and some individuals are so susceptible as to be affected by the volatile vapour which escapes from it: others handle the plant with impunity. The cutaneous inflammation caused by it will generally yield to a wash of sub-borate of soda (horax) or acetate of lead. In cases we have witnessed, inflammation appeared on the skin, in large blotches, in about 48 hours after exposure to it; chiefly on the face and extremities; soon after, small pustules appeared on the inflamed parts, and became filled with watery matter, attended with an almost insupportable itching and burning. In two or three days the eruptions suppurated, after which the inflammation subsided, and in a short time the ulcers healed.]

257. *u. Stalagmitis Cambogioides—Habradendron Cambogioides.*—The gum-resinous exudation from this plant occasions, in *large doses*, nausea, vomiting, griping pains of the bowels, copious watery stools, &c. In *excessive doses* it acts as an acrid poison. A drachm caused horrible retchings and purging, followed by syncope and death. The fatal effects consequent upon taking a great number of Morison's pills have been owing to the gamboge contained in them. The *symptoms* in these cases were vomiting and purging, pain and tenderness of the abdomen, coldness of the extremities, and sinking of the pulse. On examination *post mortem*, inflammation, ulceration, and sphacelation of the intestines were found.

258. *v.* There are many other plants, as several species of the *Rhododendron, Pedicularis, Plumbago, Phytolacca, Ricinus, Sambucus, Sedum, Tanacetum, Pastinaco*, &c., which possess very acrid properties, and which, when taken into the stomach, occasion symptoms and lesions similar to those caused by the plants already mentioned. Others produce not merely more or less inflammation and excoriation, but also other functional and organic changes, which rank them in the classes which follow.

259. *y.* 1st. The *action* of the acrid vegetables is generally exerted upon the tissues with which they come in contact, in which they occasion inflammation, excoriation, or corrosion, ulceration or sphacelation, with the symptoms usually attending these lesions, according to the parts in which they are produced. 2d. The fatal effects of these poisons are more certainly developed when they are taken into the stomach than when applied externally, or introduced into the cellular tissue; for, in the former case, they affect a greater extent of surface,

having an intimate connexion with the organic class of nerves, and, through these nerves, developing a wider range of morbid symptoms than in the latter. 3d. Some of these poisons, in addition to these local effects, are partially absorbed, and produce changes either functional or structural—nervous or vascular—in other remote organs, as the lungs, the urinary organs, the nervous masses, &c.

260. *z.* The *treatment* of the vegetable acrids consists chiefly of the expulsion of them by encouraging vomiting, by means of mucilaginous draughts; and of allaying irritation by opiates, external derivatives, emollient and anodyne enemata, and local depletions. Opium may be given in full or frequent doses, and rubefacient embrocations or fomentations assiduously applied over the abdomen. I have found the turpentine fomentations, opiates, starch enemata, with the compound tincture of camphor or sirup of poppies, the most generally efficacious; and, if vital depression supervene, camphor, ammonia, decoction of cinchona, or aromatic infusions are the most serviceable. During recovery, the *diet* and *regimen* advised during convalescence from the effects of several corrosive poisons should be adopted (§ 157–174).

261. Class II. Depressing and Paralyzing Poisons—Sedative Poisons.—There are several agents which destroy life by the extent to which they abstract the vital caloric, depress the nervous energy, and lower the action of the heart and vascular system generally. In virtue of these modes of operation, they destroy vitality without any very obvious pre-existent excitement, and without producing either the appearances or the symptoms or lesions attending local irritation. The effects of these agents are manifested by the states of function and of vital manifestation and action, and by no farther lesion than may be attributed to failure or loss of function or action; by the absence of such structural changes as are calculated to account for death, conformably with our acquaintance with the extent and consequences of pathological conditions. Of this mode in which certain poisons act, I have already taken a general view (§ 28–30). I shall, therefore, notice as briefly as possible those agents which come under this class—which destroy life by acting in this way, and independently of such structural lesions as are of themselves calculated to produce the result. It may, however, be here remarked, that there are numerous substances which, in addition to more or less manifest lesions of structure produced by them, act also as sedatives or depressants of nervous energy and vital action, which produce more complicated effects or associated results, and which thereby constitute other classes of poisons, more especially the *fifth class.*

262. *A.* Acetic Acid, in various states of concentration or purity, may be so employed as to act as a sedative. It has been considered above (§ 125) with reference to its corrosive operation, or to its employment in larger doses, and in states of strong concentration. But when taken in states of dilution, and when the use of it is continued for a considerable time, it acts not only as a sedative, but also as a slow poison. These effects depend in some degree on constitution, and the quantity of it usually taken; for, in moderate doses, both it and the *mineral acids* are tonics and refrigerants, and increase the appetite, while in larger doses, or when too long continued, they impair or otherwise affect the assimilating processes, and even change the constitution of the blood. When very dilute acetic acid is taken, especially during vascular excitement or in febrile states, it allays thirst, lowers the heat of surface, and increases the urine. It is certainly absorbed to a greater or less extent; and, both locally and through the medium of the circulation, it exerts some degree of astringent action. I have met with several instances of disorder from the protracted use of this acid, amounting nearly, and in one quite to that observed in the following case: A young lady enjoyed good health, was plump, had a good appetite, but was afraid of becoming too fat. She was advised to drink a small glass of vinegar daily: she did so, and her plumpness diminished; but, after some weeks, she began to complain of a short, dry cough; her body became lean and wasted; her breathing short and difficult, and the usual symptoms of tubercular consumption supervened. On *dissection*, all the lobes of the lungs were studded with tubercles. The long-continued use of acetic acid seems to favour the development of several organic changes which originate in debility. Morgagni believed that it favoured the production of schirrus of the pylorus.

263. *B.* Acids—The Mineral.—The action of these acids in large quantities, and in strong and concentrated states, has been already considered (§ 132, *et seq.*); in which states they act locally and as corrosives. But in states of weak dilution they operate differently, their effects varying with the quantity and continuance of the use of them. Many years ago I made a series of experiments with these acids in different states of dilution, and for various periods; and most of them were made upon myself. I found, 1st. That the *sulphuric*, the *nitric*, and the *hydrochloric acids* were severally absorbed into the circulation when taken in states of dilution short of producing corrosive effects. 2d. That, after periods varying with the amount and frequency of the dose, and with the acid taken, the presence of the free acid could be detected more or less abundantly in the urine. 3d. That sulphuric acid appeared sooner in the urine than the nitric or hydrochloric, and that the nitric required the longest time to appear, and the largest doses; but as to this particular, I was not quite satisfied. 4th. That the sulphuric acid evinced the most decided refrigerant and sedative action, especially when much diluted. 5th. That the use of these acids was at first tonic and refreshing, and to some extent astringent and diuretic; but that, when continued for some time, and when they were more abundantly absorbed, especially the sulphuric, they then were depressing; occasioning indigestion, weakness of the pulse, and in my own case, after the sulphuric acid had been taken some time, intermissions of the pulse, and impaired impulse of the heart, the urine at this time containing free sulphuric acid, or this acid in excess. 6th. That a too long continuance of these acids, particularly of the sulphuric acid, not only impaired digestion and assimilation, but also weakened the heart's action, lowered irritability, caused emaciation, disordering the bowels, and the secre-

tions poured into the digestive canal. 7th. That these acids act as refrigerant tonics only when employed for a short time in such quantity as may render drinks agreeably acid; that they are most beneficially prescribed in this manner, in order to remove a particular diathesis or specific condition; and that they are slow poisons when long continued in healthy states of the frame, the good effects often imputed to them resulting either from other causes, or from vital resistance and the efforts of nature. 8th. They affect, when continued for some time, the constitution of the blood. 9th. The mineral acids, when thus employed, are excreted from the blood chiefly by the kidneys and the skin.

264. *C.* Alkalies and their Carbonates, when taken in states of weak solution, or continued for too long a time, or in doses short of producing the effects described above (◊ 167, *et seq.*), impair more or less remarkably vital power and vascular action. These substances are readily absorbed into the circulation, whence they are eliminated chiefly by the kidneys, and slightly by the skin. The prolonged use of them may occasion slow or chronic poisoning, owing to the effects produced by them on the digestive mucous surface, and on the urinary organs; for they manifestly favour the too rapid detachment or exfoliation of the epithelium covering the villous and mucous membranes of these viscera, while they alter the constitution of the blood, and affect the healthy states of the hæmato-globulin. When thus improperly employed, their operation as sedatives tends rather to favour the origin and development of organic lesions and chronic diseases, which may ultimately terminate life, than to cause death in a more direct and immediate manner.

265. *D.* Cold.—The *abstraction of animal heat* may, from its intensity or continuance, destroy life. Cold is a powerful sedative, benumbing the sensibility, weakening muscular motion, and lowering vascular action. It also favours internal congestions, especially of the lungs, brain, and liver, and ultimately of the large veins and right side of the heart; these congestions increasing the effects of cold on the sensibility and on the vascular system to a fatal amount, unless judicious means of counteraction be adopted. The fatal effects of cold are favoured by repose; by the drowsiness, somnolency, or lethargy which it induces, and by a passive submission to this feeling; by previous excesses in spirituous liquors or intoxicating drinks, or even by the use of those at the time of exposure, if active exercise be not taken. But it is unnecessary to pursue the subject farther at this place than to associate its effects with other injurious agents, for the purposes of diagnosis, and of comparison with the action of other sedatives, or even with narcotic poisons, as this agent has been noticed above (◊ 28, 29), and *specially* treated of with reference to its *effects* and *treatment*. (*See art.* Cold.)

266. *E.* Digitalis.—*Digitalis purpurea* has been usually classed with narcotics, or acro-narcotics; but it is more properly a sedative than a stupefying agent, as this latter property is either not at all, or imperfectly evinced; and whatever narcotic effect may be considered as actually produced by it, in any instance, is to be imputed entirely to the depressed, paralyzed, or departing manifestation of cerebral function. The irritation caused by digitalis in the digestive canal is not great, does not proceed to inflammation, and is attended by marked depression of vital power. The effects produced by it on the heart obviously depend upon the quantity taken, the rapidity of its absorption, or the accumulation of it in the system, and upon the other peculiarities of the case, and particularly upon those connected with the constitution of the patient. In many its ingestion, even in a very large and poisonous dose, produces acceleration of the pulse—sometimes remarkable acceleration; but the pulse is always then weak, compressible, or small, the acceleration being manifestly, as in other cases of great quickness of pulse, an evidence of extreme depression of organic nervous influence and vital power. But, as the irritability of the heart and other muscular parts become impaired with the depression of the organic nervous influence upon which it depends, the increased frequency of the heart's action, if it have occurred, subsides more or less rapidly into remarkable slowness and irregularity, with or without intermissions, until the action ceases altogether.

267. The noxious operation of digitalis is manifested in all animals. One drachm of the powder acts as a sedative in horses affected with inflammation. Two ounces destroyed this animal in twelve hours. The influence of this poison on the heart of the horse is various. At first, the action of this organ is sometimes accelerated; in other instances it is not affected; and in some it is retarded. It generally occasions diminished muscular power, convulsive movements, tremours, and loss of sensibility. Of the numerous writers who have discussed the operation of digitalis, there is none who has estimated it so accurately as Dr. Pereira, or at least so conformably with my own experiments, and with my observations of its effects during a period of thirty years. Many years ago, I tried the effects of it upon myself in large doses, in different forms of preparation; and in practice I have pushed it, in some instances, as far as appeared compatible with the safety of the patient.

268. *a. Symptoms.*—Dr. Pereira has distinguished *three grades* of operation of foxglove, or of poisoning by this plant; and I shall adopt the division.—(*a*) *The first degree* is that usually produced by *small and repeated doses*, and consists chiefly of nausea or loss of appetite; of alteration of the heart's action and of the pulse, which becomes irregular, or accelerated, or slower than natural; of depression of spirits, of impaired strength, and of increased secretion of urine. These symptoms observe no regular order, sometimes the diuresis, at others nausea, and occasionally the affection of the circulation being the first to appear. The influence of digitalis on the circulation is by no means uniform. In some cases the pulse is accelerated or rendered full and soft; in others it is slower or irregular; in many it is intermittent; and in others it is not materially affected. A small dose, in some instances, reduces the frequency of the pulse, and renders the pulsation irregular or intermittent, or both; while a very large dose may be taken without any material effect upon the action of the heart.

In the summer of 1816, I took, while in good health, two drachms of the tincture at one dose; and, finding no farther effect from it than loss of appetite and slight depression, I took another drachm three hours afterward. I find in my note-book that the pulse was not affected by it during that and the subsequent day, farther than it was readily accelerated by the least exertion, and that very slight nausea, but no drowsiness, was produced by it. Dr. Withering, in one case, found the pulse fall to 40 pulsations in a minute, and Dr. Fogo, in another, to 36. The lowest I have seen it from the use of foxglove was 44; but 50, or even lower, is not infrequent. The slowness is sometimes preceded not only by acceleration, but also by increased fulness and softness. Even when the pulse is much slower than natural, in the recumbent posture, it generally rises very remarkably above the usual frequency in the sitting, and still more in the standing position. This is owing to the weakened state of the heart, caused by the digitalis, an increased frequency of contraction being required to compensate the loss of power, especially in positions unfavourable to an abundant supply of blood to the brain, by which the cerebral energy may be developed and the nervous influence of the heart thereby re-enforced and increased. This effect of position upon the action of the heart of a person under the influence of digitalis should be kept in recollection, and he should not be allowed suddenly to assume a sitting or standing posture; for the heart, already remarkably weakened, is unable to act sufficiently, or to overcome the increased obstacle which either of these postures furnish to it, especially when it loses the usual supply of cerebro-spinal nervous influence, or even when it experiences a diminution of that supply. Owing to these conditions, and to insufficient attention being paid to them, a patient may be seized with fatal syncope while he is under the operation of this substance; and there is every reason to believe that this occurrence has actually taken place oftener than once in these circumstances.

269. The influence of digitalis on the pulse is more remarkable in debilitated and anæmiated persons than in the plethoric or robust. Sometimes no effect is produced on the pulse in respect of number, force, or regularity, until nausea, vomiting, or headache is experienced; and occasionally a comparatively moderate dose may occasion these symptoms. Shroek, as quoted by Pereira, experienced from two grains of foxglove nausea, headache; small, quick, and soft pulse; dryness of the throat; giddiness, weakness of the limbs; and some hours afterward his vision became dim, with a sensation of pressure on the eyeballs.

270. The *cumulative effect* of digitalis is one of the most important facts to be kept in view in connexion with the use of small and repeated doses of this plant. After an indefinite time, during which the foxglove has been thus employed without any very marked effect, or with a slight effect merely, dangerous symptoms, in some instances terminating in death, have suddenly appeared. These generally consist of remarkable irregularity, frequent intermissions, or extreme weakness and slowness of the heart's action; giddiness; pallor of the countenance; nausea; vomitings; watchfulness; impaired sensibility; and sometimes convulsions. Dr. Pereira and Dr. Holland, however, consider this cumulative effect very rare. But this depends upon the time during which the digitalis has been exhibited, and the amount of the dose. Early in the present century, when this plant, especially the infusion of it, was given in large doses, and very indiscriminately, in dropsies, I met with several instances of the cumulative operation of it in most dangerous forms; and two of these occurred in patients for whom I had myself prescribed it, and in whom I had watched its effects. One of these perfectly recovered from both this operation of the remedy and from the disease for which it was prescribed (dropsy); the other also recovered from this effect, and was partially benefited by the medicine; but the disease—tubercular consumption—ultimately terminated as usual. *Salivation* is an occasional consequence of the use of digitalis in repeated doses; and it may occur even after a few moderate doses, as noticed by Withering, Barton, Pereira, and myself.

271. (*b*) *The second grade* of poisoning by digitalis is that which is most frequently produced by too large or too long-continued doses. The *symptoms* are described with great accuracy by Dr. Pereira. They are usually nausea or actual vomiting, slow and often irregular pulse, coldness of the extremities, syncope, or tendency to it, giddiness, confusion of vision, and loss of muscular power The sickness is sometimes attended by purging, but oftener by dyuresis, occasionally by neither. The patient complains of a sensation of weight, pain or throbbing of the head, especially the forehead; of giddiness, of weakness of the limbs, and watchfulness. He sees objects dimly, or of a green or yellow hue; or he sees motes, sparks, or mists before his eyes. The pulse is feeble, sometimes accelerated, at other times slow, but is affected by the slightest exertion. There is remarkable tendency to syncope upon raising the head from the pillow, and to profuse cold sweats; sometimes delirium, stupor, salivation, and loss of sensibility supervene. There is much difficulty in assigning the quantity of the drug capable of producing these effects, whether taken in a single dose or in divided quantities. Much will depend upon the state of the plant, the kind of preparation, and the constitution of the patient. I may, however, here state, as the result of experiment and observation, that very large doses—three or four times the usual doses of either of the preparations, or even more—may be given without any effect during inflammatory action; that febrile excitement, physical exertion, and a high range of temperature seem to suspend the action of even very large quantities of the drug; while the depressing passions, cold, the contemporaneous use of antimonial preparations, of colchicum, or of refrigerants, manifestly accelerate and heighten their effects.

272. (*c*) *The third or fatal grade* of poisoning by digitalis is *characterized* by retchings, purging, griping pains in the bowels, remarkable faintness, cold sweats, anxiety, and depression of spirits, collapsed features, vertigo, dilated pupil and disordered vision; a slow, feeble, irregular, and small pulse; extreme physical de-

pression and exhaustion, inability to sustain a sitting or upright posture, involuntary evacuations, low delirium, insensibility, convulsions, stupor, and death.

273. *b. The appearances after death* by digitalis have not been accurately observed. There is, perhaps, no drug which has been employed, either medicinally or criminally, the operation of which has been more inaccurately described than this has been. Digitalis produces but slight irritation of the digestive mucous surface, the nausea, retchings, &c., sometimes observed resulting more from the efforts of nature to throw off a depressing and poisonous agent than from any inflammatory action produced by it, these symptoms depending upon the reaction of vital organs upon an injurious influence affecting the ganglial or splanchnic nervous system rather than upon irritation. The symptoms which have been imputed to narcotism and to congestion of the brain arise from very different states; for the giddiness complained of, the convulsions even, and all the symptoms which may be referred to the brain, I am convinced, by careful observation, are results of impaired circulation in this organ, of weakened nervous energy, and of a deficiency of blood in the vessels within the head. I have always found the carotids pulsating weakly; the head cool, and the features sunk; and it is well known that convulsions as often result from a diminution of blood within the cranium as from congestion or excess—perhaps oftener. Doubtless, when convulsions occur, this state is altered, and congestion is the consequence; so that, when convulsions precede dissolution, a congested state of the vessels of the brain and of its membranes will be found. Digitalis acts as a poison, and even as a medicine, by depressing the organic or ganglial nervous energy, and consequently by lowering irritability and the tone of vascular action. The manifestations of life in the several organs are thereby similarly affected, the functions of absorption and of urinary secretion being the least disordered. The ultimate result is, that the depressed states of organic nervous power and of vascular action primarily caused by digitalis, impair the cerebro-spinal influence, and the functions of sense and of muscular motion depending upon that influence; and that these states severally act and react on each other when the poison is energetic, or its operation not counteracted, until the action of the heart ceases altogether.

274. *c. The treatment* of poisoning by digitalis must depend upon the circumstances of the case. If the symptoms are produced by a large quantity of the drug taken at once, and if there be reason to infer that it still remains even in part on the stomach, the removal of it either by the stomach-pump or by vomiting should be procured. The sulphate of zinc is the most suitable emetic in this case, and it should be given in a full emetic dose with powdered capsicum, and vomiting should be encouraged by means of warm diluents containing stimulants, as ammonia, camphor, &c. When the poison is evacuated from the stomach, or when the symptoms are consequent upon repeated doses of it, or result from its cumulative influence, an immediate recourse to stimulants, as brandy, ammonia, camphor, opium, cardiac tinctures, capsicum, should be had; and mustard poultices, blisters, or other rubefacients ought to be placed over the epigastrium. Strong coffee or green tea may also be freely given. In the instances of cumulative poisoning by this plant which occurred in my practice (§ 270), camphor and ammonia, with capsicum, were chiefly employed, and green tea for drink. The noxious effects of digitalis, however produced, are not readily removed, but require the lapse of several days before they entirely disappear, the disorder of the pulse and the affection of the eyes being the last to depart. During the treatment of the effects of this poison, the patient should be kept in a recumbent position, a change to the sitting posture being allowed only with the utmost care.

275. *F.* Lead.—*The preparations of lead* are severally poisonous. The metal itself is not injurious, if it remain unchanged; but when reduced to an oxide or a carbonate, it becomes injurious. Small shot have been swallowed in order to remove obstructions in the bowels, and evacuated without producing any inconvenience. Dr. Bryce (*Lancet*, Dec. 31, 1842) has recorded a case, however, of a man who took three ounces of small shot (No. 4). On the third day he complained of great depression and anxiety, with sunken features, coldness of surface, dizziness, and numbness in the arms and legs. These symptoms continued to increase; purgations were administered to overcome the obstinate costiveness, and in a fortnight he recovered. In this case the metal was either oxydized or reduced to a salt in the stomach or intestines. The chief compounds of lead which have been found injurious are, the *carbonate*, the *acetate* and *sub-acetate*, the *chloride*, the *iodide*, and the *oxide*, combined either with vegetable acids or with fatty substances; and either of these may produce *acute* or *chronic poisoning*.

276. *a. Acetate of Lead—Sugar of Lead.*—This salt is productive of acute or chronic poisoning, according to the dose, the repetition of it, or the mode of its administration. Orfila found that, in large doses, it caused pain, vomiting, and death; and that when its action was slower, and absorption took place, paralytic and convulsive symptoms appeared. Owing to the disposition of the salts of lead, and especially the acetate, to combine chemically with the tissues, the villous surface of the digestive canal, in cases of acute poisoning with this salt, is whitened or otherwise discoloured by it. Injected into the veins, or applied to wounds, it affects the nervous system, causing vertigo, paralysis, or coma, and convulsions, and congestion of the lungs.

277. *b.* The *symptoms* produced by the ingestion of this salt vary with the dose. Ten grains taken daily for seven days caused a sensation of tightness in the breast, a metallic taste of the mouth, constriction of the throat, debility, sallow countenance, slow respiration and circulation, turgid and tender gums, ptyalism, numbness of the fingers and toes, pains of the stomach and bowels, costiveness, but no nausea. These symptoms are described by Dr. Laidlaw, and agree with the symptoms I have myself observed in cases where large doses of this substance have been taken for several days. When much larger or poisonous

doses, as three or four drachms or upward, have been swallowed, a pricking, constrictive, and peculiar pain is felt in the throat and in the course of the œsophagus; pain, anxiety, and distressing aching are felt at the epigastrium, and diffusing themselves over the abdomen; vomiting takes place, and is attended by paroxysms of colicky pains, which are not increased by pressure, as in cases of inflammation, but, on the contrary, are relieved by it. Aching and anxiety, with a sensation of constriction of the abdominal contents towards the spine, are experienced in the intervals between the severe paroxysms of pain; the bowels are constipated; the skin is cold, and the strength prostrated. Giddiness, coma, convulsions, and death supervene, if suitable aid be not administered. This very *acute form* of lead poisoning is, however, comparatively rare. Much more frequently, after suffering for several days with the abdominal symptoms, the parietes of the abdomen being at first retracted, and subsequently tense and distended with air, owing to the paralyzed state of the muscular coats of the intestines, the patient complains of cramps or loss of power of the muscles of the extremities, or of numbness or complete paralysis. The bowels continue constipated; vomiting occasionally takes place, preceded or attended by severe paroxysms of pain; torpor, coma, or convulsions supervene; or death takes place suddenly or unexpectedly.

278. *c.* The effects of this salt often pursue a more *chronic* course, and then are in all respects similar to those described when treating of *painters' colic.* (*See art.* Colic, § 25, *et seq.*) Dr. A. T. Thomson (*Med. Gaz.*, vol. x., p. 689) has contended that the acetate of lead does not become poisonous until it is converted in the body into the state of a carbonate; but there is no proof of the carbonate having a more deleterious influence than the acetate. Dr. C. G. Mitscherlich has even shown that the acetate is not less injurious than the carbonate, especially when mixed with acetic acid, in which form it is more energetic than when given in the neutral state. (Taylor, *op. cit.*, p 169)

279. *d. Sub-Acetate—Diacetate of Lead—Goulard's Extract of Lead.*—This substance has caused death in a few instances, and is a more powerful poison than the neutral salt, probably owing to its containing a larger quantity of the oxide. Mr. Taylor states that two cases of poisoning by Goulard's extract occurred in 1840 in two children of four and of six years of age. The quantity taken was not great, but both died in thirty-six hours, with symptoms very closely resembling those of pestilential cholera. The bodies were inspected (§ 285). Mr. Marshall, however, mentions a case of recovery from two fluid ounces of this extract.

280. *e. Carbonate of Lead—White-lead Cerusse.*—It is insoluble in water, but still possesses poisonous properties, a decided proof, as Mr. Taylor remarks, among numerous others, that insolubility does not prevent a substance from exerting a poisonous action on the system. The gastric and biliary secretions, or the presence of a free acid in the digestive canal, may dissolve a sufficient quantity to be deleterious. In a case reported by Dr. Snow, a child, aged five years, ate a portion of the carbonate, ground up with oil, not larger than a marble. During three days, pain in the abdomen and constipation alone were complained of. On the third day the symptoms were greatly aggravated, and vomiting occurred. The child died ninety hours after the injection of the poison; some very offensive stools, of a greenish-black colour, having been passed just before death. A female, aged thirty-three, took, by mistake for magnesia, from six to eight drachms of the carbonate of lead. Five hours afterward, Mr. Cross found her in a cold perspiration, breathing heavily, with a frequent, small, constricted pulse. There were vomiting, dryness of the throat, anxious expression of countenance, and severe colicky pains. The extensor muscles became paralyzed, and the flexors rigidly contracted. Sulphate of magnesia, with dilute sulphuric acid and castor oil, were given her, and very dark evacuations were procured. In four days she was convalescent.

281. These cases sufficiently illustrate the *symptoms* of the *acute form* of poisoning by carbonate of lead. The *chronic form* of poisoning by this substance, characterized by severe paroxysmal pains in the bowels, constipation, paralysis, &c., is identical with *painters' colic.* (*See* Colic, § 25, *et seq.*) This form of poisoning is frequently caused by the absorption of the poison either by the lungs, or by the skin, or both. It has been found that, where the carbonate of lead was ground in a dry state, both the labourers and animals have died from its effects, owing to its diffusion in a state of impalpable powder in the air. Even the air of a newly-painted room, especially when it is slept in, will, in some constitutions, produce acute or serious effects; but the chronic operation of this agent is most common. The diagnostic symptoms of this latter form of poisoning have been fully stated in the article referred to; but recently Dr. Burton has shown, that blueness of the edges of the gums, where they join the bodies of the teeth, generally attends, or even precedes, the usual symptoms of this form. Dr. Chowne, however, contends that the presence or absence of this sign is not connected with the effects of lead. Chronic poisoning by the carbonate of lead is not infrequently caused by *water* which has passed through lead pipes, or been kept in lead cisterns, especially if these have been new, and if the water contain carbonic acid. Hard water, or water containing the sulphate of lime, or any of the neutral salts, produce little or no action on metallic lead. (*See* Guy's *Hosp. Rep.*, vol. iii, p. 70.

[As most of our large cities are supplied with water from lakes or streams conducted to reservoirs, and hence distributed, through iron or lead pipes, to the inhabitants, it becomes a question of great importance whether lead should be employed for such a purpose. The following facts are worthy of record in this connexion:

"The salt of lead formed by the contact of water with the metal is the carbonate. This salt is produced either by the action of water containing carbonic acid, or by water containing little or no saline matter. The carbonate is mixed with a small proportion of the hydrated oxide of lead. In the case of pure water, the free access of atmospheric air is essential to the change, for distilled water deprived of its gases by boiling, and excluded from the air, has no action on lead. When rain, or distilled,

or very soft water is left in contact with pure lead, with the free access of air, a white powder collects in a few minutes around the metal, and this goes on increasing till, in a few days, white, pearly scales are formed, which either float on the water, or fall to the bottom of the vessel. The formation of the carbonate and the corrosion of the metal go on as long as the air has free access to the water. At the same time a small quantity of lead is dissolved.

"On the other hand, various saline substances held in solution in water have the effect of preventing the formation of the carbonate. Indeed, all the neutral salts possess this power in a greater or less degree. Sulphate of lime affords the most complete protection, so small a quantity as one part in 5000 effectually preventing the formation of the carbonate. Some kinds of river water, as that of the Thames and the water used in Edinburgh, contain saline matters in sufficient proportion to render the use of lead perfectly safe. The same remark applies to most spring waters. But the waters of some rivers and springs are so destitute of saline matters as to act powerfully on lead.

"It may be stated, then, as a general result, that the action of water on lead, and the consequent danger of conveying and preserving it in pipes or cisterns made of that material, varies directly as the purity of the water. It follows that we may render the use of lead for such purposes perfectly safe by the artificial admixture of saline matter with the purer kinds of water. Sulphuric acid, by forming an insoluble sulphate of lead, is also an efficient protection. The use of lead is attended with most danger when it is employed to collect or preserve rain or snow water, or spring water of unusual purity, and the danger is increased by the use of leaden lids to cisterns, the pure water rising by a natural process of distillation, and collecting on the lid.

"There is one cause which greatly facilitates the action of water on lead, and which may act with sufficient energy to neutralize the preservative effects of saline matter, and be even increased by its presence, namely, the galvanic action excited by the contact of some other metal with the lead, or of the solder used for joining the sheets of lead. It must, moreover, never be forgotten that carbonic acid, if present in the water, will completely counteract the preservative effect of the salts above mentioned. We cannot, indeed, too strongly deprecate the use of lead for cisterns and water pipes under any circumstances."

The Croton water of New York contains only about four grains of solid matter to the gallon, and is consequently so pure as to act upon lead with great rapidity. The same remark will apply to the water about to be supplied to the city of Boston. Mr. Ewbank, of New York, has invented a process of tinning lead pipe, which is said to render it perfectly safe against the action of water. But it is evident that if any portion of the pipe remains untinned, galvanic action will be set up, and the lead dissolved still more rapidly. On the whole, *iron* pipes only should be employed for this purpose. See my appendix to Towers's *Illustrations of the Croton Aqueduct*; New York and London, 1843.]

282. *f. Iodide of Lead.—Pulmbi Iodidum.*—As this substance is employed in medicine, it is necessary that the injurious effects produced by it should receive attention. It is a fine yellow powder, sparingly soluble in cold water, but readily soluble in boiling water. Twenty-four grains of the iodide were given to a cat, in two doses, with an interval of four hours between them. The animal suffered violent colic, and died in three days; but no signs of irritation were observed after death. Iodide of lead in doses of from five grains to thirty were given to a bulldog. On the fifteenth day the animal refused food, and kept in the recumbent posture. He died on the eighteenth day, having swallowed altogether upward of ten drachms of the iodide. During the whole period he had only three or four intestinal evacuations. I have employed this substance both internally and externally; but it has not, in the form I have prescribed it, produced any marked signs of irritation.

283. *g.* The effects of the *chloride of lead* and of the *chromate of lead* I have not observed; but there is every reason to believe that they would be poisonous in large doses, the latter especially. The *sulphate of lead* has usually been considered as inert by Orfila and others. The *nitrate of lead* acts in a similar manner to the acetate.

284. *h.* The *Oxides of Lead.*—The *yellow oxide*, and the *brown oxide—peroxide*—are but little known unless to chemists. *Litharge* and *minium* (*red-lead*) are much used in the arts, and have caused poisoning accidentally. Liquids used for culinary or dietetic purposes, especially if they contain a free acid, may become impregnated with oxide of lead, derived from the glaze of the vessel in which they are kept forming poisonous salts. Litharge glaze may also be dissolved by alkaline and fatty substances. All newly-glazed vessels yield traces of lead on boiling in them acetic acid or caustic potash; the oxide of lead being dissolved by the acid or alkali. Litharge was formerly much employed to remove the acidity of sour wine, and convey a sweet taste; an acetate, or some other vegetable salt of lead being in these cases formed. Many years since, a fatal epidemic colic prevailed in Paris owing to this cause. The adulteration was discovered by Fourcroy. *Wine* thus adulterated is known by its being blackened by hydro-sulphuret of ammonia. *Cider*, *new rum*, and *sugar* are sometimes the medium of conveying the salts of lead, owing to lead or its oxides being employed in certain parts of the apparatus or substances used in their manufacture. Dr. Trail found that, when new rum is kept in oaken casks, the tannin of the oak is slowly dissolved by the spirit, and the lead is precipitated in an insoluble form, the spirit thus becoming wholesome.

285. *i. The appearances observed after death* from lead poison have been very loosely described; and those which have merely been the results of congestion, of the coagulation of the blood in the veins and venous capillaries, with more or less discoloration from the chemical action of the poison, have been stated to have been inflammatory. Dr. Mitscherlich found that, when the dose of the acetate was large, the villous surface of the stomach was chemically changed by it—softened, corroded, and reduced to a whitish colour, owing to the combination of the salt with the tissue. When

given in a small dose, the acetate was decomposed by the gastric secretions, and exerted no corrosive action on the villous surface. When this salt was reduced to a state of an albuminate and dissolved by acetic acid, death took place with great rapidity; but the stomach was not found corroded. This effect was produced by the neutral salt only, and not when the dose was small, or when the poison was combined with an acid. (Taylor.)—In the cases of poisoning with Goulard's extract mentioned above (§ 279), the villous membrane of the stomach was found by Dr. Bird of a gray colour, but otherwise perfectly healthy. The intestines were contracted, in one instance more so than in the other. In a case of acute poisoning by this extract that terminated fatally in forty-eight hours, the villous coat of the digestive canal, from the œsophagus downward, was softened, and was said to present inflammatory appearances. The mucus on the internal surface of the canal contained much of the poison. The changes observed after death from the *chronic form* of poisoning by lead are described at another place. (*See* Colic, § 25, *et seq.*)

286. *k.* The *modus operandi* of the preparations of lead deserves attention. These preparations, according to their physical conditions and modes of administration, may act locally or remotely, or in both ways. Certain of them, as the neutral acetate, by combining with the tissues, may act chiefly locally, and be only slowly absorbed. Their remote action may arise from their absorption from the digestive canal, from the skin, or from the lungs. When thus absorbed, to such an amount as to affect the organic nervous and vascular systems, the following effects appear: the temperature of the body sinks, the pulse becomes smaller and slower, the capillaries are somewhat constricted, the secretions from mucous surfaces diminished, and hæmorrhages, where they exist, are checked. This sedative and constringent operation is manifested chiefly in exhaling and secreting surfaces and organs. If the poison continue to be absorbed, the nervous and muscular systems are more or less affected, and the nervous and muscular systems of organic life are the first to betray disorder; as evinced by anxiety at the epigastrium, colicky pains through the abdomen, especially in the course of the colon, spasm of the muscular coats of the bowels, impaired secretion, and constipation. As the effects proceed, pain extends to the spine and to the limbs, spasms affect the muscles, especially of the extremities, or partial loss of sensibility or of the power of motion, or of both, appears. Ultimately the palsy becomes more or less complete, or giddiness, sopor, coma, or convulsions supervene, or even death takes place preceded by either of these.

287. Thus a *sedative* and an *astringent* action, and subsequently *morbid sensibility*, followed by *spasm*, and next by *palsy*, are produced by the absorption of these poisons. These effects generally appear to a greater or less extent, *first*, in the organic or involuntary, and extend to the animal or voluntary, nervous, and muscular systems. But occasionally they are only slight in the former, although severe or even fatal in the latter; or they are most severe in, or altogether limited to, the former. There can be no doubt of these effects being produced by the presence of the poison, in the state either of an oxide, or of a salt, or in some other form or compound, in the blood, and in the tissues. Orfila detected lead in the urine of a female who swallowed an ounce of the acetate; Tiedemann and Gmelin in the blood of animals poisoned by it; Mr. Taylor in the milk of a cow poisoned by the carbonate; and Professor Cozzi, Wibmer, and others, in the blood, muscles, and viscera, after painters' colic.

288. *l. Treatment.*—The more *acute form* of poisoning by any of the preparations of lead requires the exhibition of demulcents or diluents, holding in solution some sulphate—as of soda, magnesia, potash, or alumina. If vomiting does not follow the free exhibition of these, the sulphate of zinc may be given, or the stomach-pump be cautiously had recourse to, or the throat or fauces may be tickled. If the patient has been poisoned by the *acetate*, the carbonates should be avoided, as they would increase the activity of the poison, while the sulphates would render it inert. Albumen and casein, the albuminous principle of milk, precipitate the oxides of lead, and are, therefore, excellent antidotes when given in large quantities. The treatment should be somewhat different in cases of acute poisoning by the *carbonate of lead*. Mr. Taylor remarks, that the alkaline sulphates should not be employed as antidotes for these, since it requires long digestion at a high temperature for these salts to react on the carbonate of lead, and even then the decomposition is only partial. He suggests, therefore, the administration of an alkaline sulphate mixed with vinegar, or some weak vegetable acid, such as lemon-juice. Emetics or the stomach-pump should also be employed. Afterward the bowels ought to be duly evacuated, and oleaginous and demulcent enemata thrown up. If irritability of stomach continue, opium should be given, and the colicky and paralytic symptoms ought to be treated as advised in the article Colic (§ 60–68).

289. *G.* Hydrocyanic Acid and the Cyanides.—*Oil of bitter Almonds*, &c.—*Prussic acid*, since its operation has been more generally known, especially as respects its rapid and unerring effects, has been frequently employed for self-destruction, and in some instances even for murder. Death has also occurred from it, owing to accident. In 1837–8 there were twenty-seven cases of poisoning by it, nearly all of which were suicidal. This substance has been variously classed by writers on *Medical Jurisprudence*; some have viewed it as a *narcotic*, because it produces insensibility in fatal cases. Others have considered it as an *irritant* poison, because it often produces spasms or convulsions, although no evidence of irritation is furnished by it on the tissues. But spasms or convulsions attend all intense impressions on the nervous system, especially when these impressions destroy life. Others, again, believe it to be both narcotic and irritant, or *narcotico-irritant*; and, not being content with imputing to it a single property which it does not possess, assign to it two properties of which it is equally devoid; for no one becomes unconscious from it, or is spasmodically or convulsively affected by it, if, indeed, they be so affected at all, until life is departing or about to depart. As it, therefore, *annihilates* the manifestations

of life in a few seconds, and in a way in which no irritant or narcotic ever acts, however energetic, comparing its action with theirs; and as there are no other terms which convey the idea of its mode of action better than *sedative* or *paralyzing*, I am obliged to adopt them, as indicating the *privation of sensibility and all vital action*, the chief properties evinced by it, when applied in a poisonous dose to a living body, as indicating the *annihilation of life*.

290. Common hydrocyanic acid is a mixture of the pure or *anhydrous acid* with water, and sometimes with alcohol. As it is kept in shops, it varies from 1·3 to 6·5 *per cent.* of the anhydrous acid. The *two* chief forms in which it is kept are that of the London Pharmacopœia, which contains 2 *per cent.*, and that of Scheele, which contains from 4 to 5 *per cent.* of anhydrous acid.

291. *a.* The *symptoms* caused by poisonous doses of this acid vary with the mode of exhibiting it, and with the quantity up to a certain amount; but, beyond that, the effects are tolerably uniform. *Inhaling the vapour* of hydrocyanic acid produces death more rapidly than any other mode of employing this poison. Dr. Pereira caused the almost instantaneous death of a rabbit by applying its nose to a receiver filled with the vapour. This acid also acts rapidly when applied to an *abraded surface* or to a *wound*. Sobernheim states that an apothecary at Vienna died within an hour after the entrance of the acid into a wound in the hand produced by the glass vessel in which it was contained. Even when applied to the sound skin it produces some degree of action. After applying Scheele's acid to the fingers a short time, I experienced numbness, extending considerably above the place of application, that continued for several hours, and on one occasion the whole day. Dr. Christison says that M. Robiquet's fingers were numb for several days after their exposure for some time to the vapour of the acid. Judging from these facts, this acid cannot be viewed as devoid of influence upon the *unabraded* or *whole skin*.

292. *b.* On *mucous membranes* this poison acts with rapidity and certainty. Mr. Nunneley, whose researches into the operation of this substance have been most extensive, states, that when applied upon a mucous membrane, as the conjunctiva, the rectum, or the vagina, prussic acid acts with as great rapidity as when swallowed. A knowledge of this is of importance, as poisoning may be effected in this way, and detection of the crime would be very difficult. The action of the acid on the lungs, when air impregnated with it is breathed, is not only rapid, but certain in its effects, and is one of the easiest modes of exhibiting it, but the most difficult, after a few hours, to detect, as the odour, being so diffusible, is very soon dissipated.

293. *c.* When *swallowed*, prussic acid produces almost instantaneous effects, if the quantity be sufficient to destroy life, or if the stomach be not loaded with food, which may intercept a large portion of it, and delay its operation.* But the *symptoms* produced by a dose hardly or barely sufficient to cause death are different from those observed when the quantity is large, and death very rapid. The effects are more rapid and certain in young and delicate persons; in weak constitutions, and when the stomach is empty, than in the middle-aged and the robust, and when the stomach contains more or less food.—(*a*) A *small, poisonous dose* occasions a bitter, warm taste, which is soon followed by sensations of faintness and giddiness. The respiration becomes slow, difficult, and spasmodic, the pulse small or imperceptible; and insensibility supervenes, often with convulsions; a state resembling an epileptic paroxysm being sometimes produced. The pupils are either contracted or dilated, and the eyes staring. If the treatment about to be recommended be resorted to in this state, recovery usually takes place rapidly, vomiting often occurring.

294. (*b*) In *a large or rapidly fatal dose*, the phenomena are such as hardly admit of observation; death follows so quickly, and is attended by so few symptoms, excepting the cessation of sensibility, of breathing, and of the heart's action. In the case of a chemist in my vicinity who took more than an ounce of Scheele's preparation, death must have occurred in a few seconds, neither spasms nor convulsions having been observed. In a case communicated by Mr. French to Mr. Taylor, seven drachms of the common prussic acid were taken, and about two minutes afterward he was found lying on the floor insensible. There were no convulsions of the limbs or trunk; but a slight flickering motion was observed about the muscles of the lips. Respiration seemed to cease for some seconds; it was then renewed in fits, expiration being deep and slow. The deceased took the poison while ascending the stairs; his body was found on the landing; the bottle had rolled some distance from him; the stopper was lying in another direction. Simon relates a case in which an ounce was taken; the symptoms were the same. The hands and feet were cold, and no pulse could be felt. The finger-nails are often of a livid colour, and the hands clinched. When the dose is large, the odour of the acid is generally exhaled from the mouth.

295. *d.* The utterance of a *scream* or *shriek* has been said to be indicative of poisoning by this acid; but Mr. Taylor states that this symptom does not occur in the human subject; and Mr. Mills, the deputy coroner, says that his inquiries show that it does not occur. There is merely a gasping for breath, or a low moaning or sobbing noise. Mr. Nunneley found that the shriek or cry did not occur in more than about one half the number of cases of animals, and only in one third very loudly. When it was uttered in animals, it was of a peculiar kind, and so indicative of distress as to give an idea of consciousness on the part of the animal of impending death; it was characteristic of the poison. When the dose of prussic acid is small but still fatal in the human subject, *convulsions* have sometimes been observed; but they have not been met with when the dose has been large and death rapid. In these latter cases the symptoms have been scarcely noticed, but are probably the same as seen in the lower animals, namely, imperceptible pulse,

[* Hydrocyanic acid never operates instantaneously, as we believe, there always elapsing a sufficient interval for it to reach the brain through the medium of absorption. This fact has been abundantly proved by the experiments of Mr. Blake.]

insensibility, a few deep and slow respirations, and death. Mr. Nunneley's experiments, as well as the history of several cases in which large quantities of this poison have been swallowed, show that death is seldom so rapid as to prevent volition and voluntary motion being exercised for a few seconds afterward; but in a few seconds death often takes place without a struggle. The most rapidly fatal case with the particulars of which I am acquainted, was that of a gentleman whom I knew, and which occurred in 1828. Above an ounce of Scheele's acid was taken. Instantly upon swallowing it, he must have repented of his act, for he hastily called out, brandy, ammonia, repeating the words, fell down, and never moved afterward. In some few instances, Mr. Nunneley found the action of the poison so expeditious as to prevent the slightest exhibition of voluntary motion; but in the majority of warm-blooded animals and dogs, about twenty seconds elapsed before the symptoms were manifested; thus allowing, presuming that a similar interval would occur in man, sufficient time for several acts being performed, which were supposed by many to have been doubtful, if not impossible, after the ingestion of the poison.

296. *e.* It has been supposed that this acid possesses an *accumulative property;* that after having been taken for some time, in moderate doses, without any apparent mischief, it may, without any remarkable increase of quantity, suddenly give rise to all the effects of poisoning. Mr. Taylor states that one case is reported which renders this opinion probable, and another has been communicated to him which tends to confirm it. Dr. Lonsdale, who has paid some attention to this matter, does not admit that prussic acid possesses this property, on account of its volatility and diffusive influence; and although I have very frequently prescribed this substance, I have not seen any proof of an accumulative influence. Mr. Taylor states that serious effects have followed slight alterations made in the dose; but I have never met with such. The proper test is to observe whether or no such effects follow the persistence in the use of the same dose. It is very important, practically, to determine the question.

297. *f. Post-mortem Appearances.*—In cases of suicide or accident, the vessel which contained this poison will generally be found near the body. But the person poisoned may have thrown it from him upon swallowing its contents. The body commonly exhales an odour of prussic acid for some time after death; but if it has remained exposed for some time before it is seen, and especially if it be exposed to the open air, or in a shower of rain, the odour may not be perceptible. Putrefaction is said to be accelerated after death by this poison. This appeared to have been the case in two instances which I had occasion to observe. Mr. Taylor doubts this effect. Orfila states that in most sudden deaths, from whatever cause, putrefaction is, *cæteris paribus*, accelerated. Externally the body is commonly livid; the nails are blue, the hands clinched. The jaws are closed; and there is some foam about the mouth, especially when death has been preceded by convulsions. The face is bloated and tumid; the eyes prominent, shining, and glassy; and the veins are congested with dark blood. The stomach and alimentary canal are generally in a natural state; the internal surface being sometimes red or congested, as often seen after sudden death. The lungs are generally more or less congested. The brain is usually congested, especially in the less rapidly fatal cases, and when convulsions have preceded death. The blood is sometimes found quite fluid, in others thicker or semi-coagulated It is generally of a dark colour; but Mr. Taylor, quoting Heller and Metzdorff, says that it is occasionally red, or even of a pinkish hue. Other changes noticed hy writers may be viewed as accidental. Indeed, there is no organic alteration observed that can account for death from this poison. Those now stated — and they are the chief met with—are slight, and are seen in other cases of sudden death. Life is so soon destroyed by this agent as not to allow of any change beyond simple congestion taking place. In a case reported by Dr. Geoghegan, where an ounce of the acid was swallowed, a patch of dark-red extravasation was found under the villous coat near the pylorus. In a case recorded hy Mr. Pooley, the blood was of a very dark colour; but the lungs were not congested; in one by Mr. Hicks they were much congested; while in another by Mr. Nunneley they were only partially congested. In an instance reported by Mr. Crisp, the abdominal and thoracic viscera were all healthy, the blood imparting to them a purple hue. (Taylor.)

298. On opening the stomach the *odour* of prussic acid is frequently perceptible, and if the quantity taken has been large, the odour may continue for several days after death. If the inspection has been recent after a large dose, the odour is often perceived in all the cavities, and even in the blood. This odour has a distant resemblance to that of bitter almonds; but it is accompanied with a peculiar impression of acridity on the nostrils and back of the throat. But this odour—the diluted odour of bitter almonds—may be perceived by some persons, and not hy others; or it may be entirely absent. It may not be present, or not perceived in a very sensible manner in the dead body, if the dose of the poison has been small; if the patient has survived a short time after it has been taken; if it be masked hy other odours; and if the body has been dead some time, or has been exposed to the air, &c. (§ 297).

[In a case which occurred in this city this day (March 22d, 1848), where a gentleman of middle age took a large quantity of hydrocyanic acid, and died in his chair, the body presented a livid appearance. The pupils of the eyes were much dilated, and the muscles of the body very rigid. On opening the chest, the lungs were found of a dark colour and much congested with blood, and presented the appearance of liver when cut. The liver was of a dark colour, and congested. The left side of the heart was empty. The right side contained a little fluid blood. The stomach contained about a gill of dark, bloody fluid, which emitted a strong odour of prussic acid. The mucous membrane was of a dark-red colour, softened and corrugated. The intestines were of a red colour. The existence of prussic acid in the stomach was so evident that there could be no doubt it

was the cause of death. In two other cases, the odour of the acid was evident on opening the cavity of the chest, as well as the stomach]

299. *g. Relation between the Rapidity of the Effects and the Quantity and Concentration of the Poison.*—Dr. Christison has shown, that beyond a certain dose the weak and the strong acids appear to act with equal rapidity. Experiments on animals and facts observed in the human subject, show that a dose of the poison sufficient to cause death may have this effect in as short a time as a very much larger one; that a drachm of Scheele's acid may cause death as rapidly as three or four times the quantity, especially if the poison be taken on an empty stomach, and if the person he weak, or debilitated by disease. It hence follows, that if two drachms of this acid be fatal in a given time, it cannot be inferred that twice or four times the quantity will be fatal in one half or one fourth of that time. Mr. Nunneley states, "that, when called to a person poisoned by this acid, we cannot, merely from the length of time he has survived, or the evidence of the symptoms, determine any thing with certainty as to the degree of concentration or dilution of the acid, nor, except within wide limits, much as to the absolute quantity taken." (P. 83.) He, moreover, found that concentration does not heighten the effects of this poison, but that dilution to a moderate extent even renders them more speedy, probably from bringing the poison in contact with a larger extent of surface at the same instant. It may happen that a dose just sufficient to destroy life may fail, or be longer in producing its effects, owing to its interception by the food on a full stomach, or by other circumstances pointed out above; but a quantity sufficient to destroy life under any circumstances may have this effect with as great rapidity as three or four times that quantity. Hence there is no relation, beyond a certain amount, between the rapidity of the effects, and the quantity or concentration of this poison.

300. *h. Quantity required to destroy Life.*—Dr. Geoghegan relates an instance of a quantity of the acid having been taken equal to twenty-seven drops of the dilute acid of the London Pharmacopœia (at two per cent.) without any effect, the dose having been gradually raised to this amount; hut when the dose was raised to thirty-six drops, the patient in two minutes was seized with the usual symptoms, and nearly lost his life. The quantity of anhydrous acid swallowed in this dose was only about two thirds of a grain; but, as this substance had been taken in gradually increased doses, the probability of an accumulative effect having here resulted should be taken into consideration: a question of great practical importance, but one which is solved with difficulty. Mr. Hicks furnishes, in the case which he has reported, the *smallest dose* which has been determined with accuracy as productive of death. A healthy adult female took a dose equivalent to *nine tenths* of a grain of anhydrous prussic acid, to forty-nine drops of the dilute acid of the pharmacopœia, and to twenty-five of Scheele's acid. She died in twenty minutes. In a case observed by Mr. T. Taylor, a stout, healthy man swallowed exactly the same quantity by mistake, remained insensible for four hours, when he vomited, and began to recover. The vomited matters had no odour of the poison, and hence absorption of it had probably taken place. This quantity, nine tenths of a grain of anhydrous acid, or *one grain*, may therefore be viewed as sufficient to destroy human life, although a somewhat smaller dose may have this effect in certain circumstances, or a somewhat larger dose may fail of producing it in others. Mr. Taylor thinks that the *largest dose* from which an adult has recovered was in a case reported by Mr. Nunneley. The person swallowed forty minims of an acid, at 3¼ per cent. The man was for a short time conscious, got into hed after taking it, and spoke. He felt his jaw become stiff, and then remained insensible until roused by the cold affusion. Although recovery took place in this case, still the inference just stated as to the quantity which may destroy life, remains unaffected by it.

301. *i.* The *period at which death takes place* differs in different cases, although the dose taken may have been the same. This may be expected from the different circumstances above shown to influence the operation of poisons. In the seven cases which occurred in Paris, from the same dose of the poison given to each at the same time, death took place after periods varying from fifteen minutes to three quarters of an hour. It is only when the dose is just sufficient to cause death that an individual survives from half an hour to one hour; but I know of no case in which the period was longer than an hour. In one instance, in which seven drachms were taken, death took place within five minutes; and in another, where an ounce was swallowed, within ten minutes. In the case referred to as that in which the smallest fatal dose was observed, death occurred in twenty minutes. When the quantity is two drachms or upward, the period of death varies from two to ten minutes.

302. But it is necessary to distinguish between the periods at which insensibility and absolute death take place; for, although death does not commonly ensue until after a few minutes, insensibility, the loss of volition and consciousness may occur in a few seconds. Dr. Lonsdale states, that a drachm of Scheele's acid would affect an ordinary adult within the minute, and three or four drachms within ten or fifteen seconds. When the acid is stronger, and the quantity larger, he believes the annihilation of the sensorial functions to be immediate. Mr. Taylor remarks, with reference to this topic, that while, as a general rule, insensibility may supervene from a large dose in a few seconds, the individual occasionally retains a power of performing certain acts indicative of consciousness, volition, and locomotion, for a few seconds.

303. *k. Diagnosis of poisoning by Prussic Acid.*—But little is required to be said as to this topic, after what has been already advanced. The effects of this poison will be readily distinguished from those of *opium* or of other *narcotics* or *acro-narcotics*, as the coma caused by these poisons is seldom seen until after the lapse of a quarter of an hour, or twenty minutes; while insensibility from this acid, even in small doses insufficient to cause death, is very rarely delayed beyond two minutes. Besides, the patient may be roused from the narcotic influence of opium or other narcotics;

but he cannot be roused from that produced by prussic acid until he entirely recovers from it. Convulsions furnish no diagnostic evidence. In poisoning by this acid, a fatal issue always occurs within an hour, more frequently within a quarter of an hour; while poisoning by the substances referred to seldom terminates fatally before a period varying from six to twelve hours. The odour of the acid, when perceived, is also an important diagnostic proof (§ 297, 298).

304. It is of the greatest importance that the effects of this poison should not be confounded with death from *epilepsy*, *apoplexy*, or *disease of the heart*, in either of which death may take place within the period in which prussic acid proves fatal. A *post-mortem* examination will generally furnish the diagnosis, when no other evidence can be obtained, or can be depended on, especially as regards apoplexy and cardiac disease; but as respects epilepsy the proofs may be incomplete, unless the odour of prussic acid be present. It may likewise be important to determine whether the poisoning by this acid has been *suicidal* or *accidental*, especially if the life of the individual be insured. In general, the several circumstances observed in connexion with the case are such as at once explain the nature of it; but there are no means by which suicide may be more secretly perpetrated than by that now discussed. As to this topic, I must refer the reader to what has been stated by Mr. Taylor and Dr. Christison.

305. *l. Modus operandi.*—The local and primary operation of this poison is certainly upon the nerves of the part. This is shown by the numbness produced by it when applied even to the unabraded skin. In some experiments I made with it many years ago, it was found to impair the irritability of muscular parts, and in some instances to destroy this property altogether in those parts to which it had been applied. It also in these experiments caused dilatation of the capillaries, with congestion and stagnation of the blood in them. That the local impression made upon the nerves, more especially upon those of the cerebro-spinal system, is rapidly transmitted to the brain, medulla oblongata, and spinal cord, cannot be doubted; for the abolition of the functions of those parts of the nervous system is generally so instantaneous, especially when the stomach is empty, that it cannot be imputed altogether to absorption of the poison, although absorption undoubtedly takes place very rapidly, and destroys life: the insensibility resulting more immediately from the impression of the poison, the arrest of the heart's action, and death proceeding consecutively from the absorption of it. That this poison is absorbed is fully proved by the detection of it, by chemical agents, in the blood, and by the odour of this fluid in the cavities when they are opened, and in several viscera; thus showing that its operation on organs remote from the part to which it is applied, and the death of the individual, take place mainly through this channel; that the heart is paralyzed, and its action altogether arrested by the presence of the poison in the blood. There is, however, sufficient reason to believe that the very decided and immediate impression produced by it upon the nerves of the part to which it is applied is rapidly propagated to the *medulla oblongata* and brain, through the medium of the nerves, before the poison reaches the nervous centres, or heart, by the medium of absorption, or through the channel of the blood; for Mr. Nunneley found that, "when the acid was administered by the rectum or the vagina, both hind legs of the animal were sooner affected than the anterior part of the body." (P. 76.)

306. The *cause of death*, in cases of poisoning by prussic acid, appears, after the best attention I can give the subject, and after much experience of its medicinal effects, to result as follows: 1st. The deleterious impression made by the poison upon a sufficiently large surface, or to a certain amount, being transmitted by the nerves to the *medulla oblongata or its vicinity*, causes insensibility, and, if that impression is not of overpowering or annihilating intensity, convulsions also. 2d. That the deleterious impression is less violently, or more slowly developed or extended through the ganglial nervous system; and that, before life is destroyed by the impression made on the nervous system, absorption of it, to a greater or less amount, into the circulation takes place; and, 3d. That the presence of the poison in the blood entirely abolishes the already impaired respiratory and circulating functions by its action upon the nervous centres, and on the heart itself. The poison may thus be viewed as acting primarily upon, and through the medium of the nervous system, and consecutively, by absorption and through the channel of the circulation; the latter completing what the former mode may have failed of accomplishing.

307. *m. The chemical combinations of hydrocyanic acid* are more or less poisonous.—(*a*) Coulon, Robiquet, Schubarth, and Magendie have demonstrated the poisonous action of the *hydrocyanate of ammonia*, and of the *hydrocyanate of potass*. A dog was killed in twenty minutes with twenty drops of the diluted acid neutralized by ammonia; and another in three hours by twenty-five drops neutralized by potash. Nevertheless, ammonia is one of the best antidotes to the action of this acid, when administered after the poison. Orfila relates a case in which six grains of the hydrocyanate of potassa proved fatal within an hour in the human subject, when administered in an injection.

308. (*b*) The deleterious properties of the *ferrocyanates or triple prussiates* are much more doubtful than those of the former. Some experimenters with it have found that the *ferrocyanate of potass* is poisonous in large quantities; while others state that it possesses little or no deleterious property. Wollaston, Marcet, Emmert, Macneven, and Schubarth say that a drachm, or even two drachms, of this substance may be given with impunity to man or the lower animals.

309. *c. The sulpho-cyanic acid*, a substance analogous in its nature to the ferrocyanic acid, was once supposed, like it, to be a poison of great activity; but this, Dr. Christison adds, admits of some doubt. Dr. Westrumb considers it more poisonous in the form of *sulphocyanate of potassa*. Wimber reports that Soemmering found both this acid and the salt to be poisons of great energy; for half a drachm of concentrated sulpho-cyanic acid given to a dog occasioned immediate death, and the same

quantity of the salt killed another in one minute. These substances require farther investigation. They are certainly more energetic than they have been viewed by Dr. Christison. Dr. Westrumb detected this salt in the blood and in the viscera.

310. (*d*) *Cyanide of potassium* is a poisonous salt much used in electro-gilding and plating. It is a solid, sometimes a chalky-looking, at others a crystallized substance, and without odour until put into water, when it is freely dissolved, forming an alkaline solution, from which prussic acid is abundantly evolved. It is used medicinally on the Continent. Mr. Malaguti states that a dog was killed in a few minutes after taking less than three grains of the cyanide in solution, and that the largest dose that should be given to the human subject is five sixths of a grain. A person was killed at St. Malo by too large a quantity of it having been prescribed. Another person died at Breslau after fifteen minutes from taking a dose of a mixture containing fifteen grains of this substance. The symptoms were the same as those produced by the pure acid.

311. *n. Various vegetable substances contain hydrocyanic acid*, and are poisonous in consequence. The plants which have been found to yield hydrocyanic acid belong to the division *Drupaceæ*, of De Candolle's natural order *Rosaceæ*. They are the *bitter almond*, *cherry laurel*, *bird cherry*, *peach*, and the *mountain ash*. The poison is procured from these, according to Dr. Christison, in two forms: as an essential oil, and as a distilled water. The *distilled waters* yield hydrocyanic acid, and an essential volatile oil, which also retains much of this acid, which is peculiar, and which requires farther investigations into its constitution and effects; but I must refer the reader to Dr. Pereira's *Materia Medica*, where the subject is fully discussed. (See vol. ii., p. 1536.)

312. (*a*) *The volatile oil of bitter almonds*, and even the bitter almonds themselves, are poisonous, and owe this property to prussic acid, none of which, however, exists already formed in the kernel of the fruit, nor is it produced unless by the agency of water on the kernel. Even the mastication of the kernel produces the poison which destroys life. Mr. Taylor found that mere trituration of the almond kernel with water produced hydrocyanic acid. There are instances on record, wherein these almonds, when eaten in large quantity, have produced dangerous symptoms, and even death. The *volatile essential oil* is a most active poison; its deleterious action depending entirely upon the hydrocyanic acid which is intimately combined with it. Five pounds of the almonds are said to yield about half an ounce of the oil, and the quantity of anhydrous acid contained in it varies, according to Dr. Christison, from eight to fourteen *per cent.* It is thus at least four times as strong as the dilute prussic acid of the pharmacopœia. Sir B. Brodie, happening to touch his tongue with a rod which had been dipped in this oil, suffered almost instantaneously an indescribable sensation at the pit of the stomach, feebleness of the limbs, and loss of power over the muscles; these effects being, however, quite transient, but sufficiently evincing the rapid propagation of the deleterious impression through the medium of the nervous system.

313. Several instances of poisoning by this oil are recorded; and some have been noticed by Christison, Pereira, and Taylor. The last of these writers adduces the following: A druggist swallowed by mistake half an ounce of "almond flavour." In half a minute he fell down in a state of syncope, his face being deadly pale, and his pulse imperceptible. After some time he rallied, and vomited some undigested food and bile strongly impregnated with the odour of bitter almonds. Delirium, with slight convulsions, came on. He then became sensible, and conversed upon his condition; but he again gradually relapsed into delirium, his eyes being prominent and brilliant. In a few minutes he again became sensible, and slowly recovered. The quantity of "almond flavour" which he had taken contained about half a drachm of essential oil. In a case which occurred to Dr. Bull of Hereford, seventeen drops of the oil destroyed the life of a woman aged forty-nine in half an hour. Mr. Taylor here justly remarks upon the disgraceful state of medical police and legislation in this country, in the fact of a most virulent poison being sold for the purpose of flavouring pastry and liqueurs; but Mr. Taylor cannot surely be ignorant that British legislation does not concern itself with means which either destroy or preserve human life, until public opinion or an overwhelming necessity compels attention to such matters, and then they become objects of disgusting jobbing and disgraceful traffic, the measures which they produce benefiting chiefly the subservient supporters of a political party, the members of a clique, the satellites of power, and the worshippers of mammon.

314. Even a very small dose of this oil may cause fatal effects. Mr. Taylor, among other interesting cases, gives the following: A girl about eight or nine years of age swallowed about a teaspoonful of "ratafia," composed of one part of the essential oil of bitter almonds and seven parts of spirit. About seven drops of the oil were taken. When seen immediately after the accident there were complete insensibility, closed eyelids, brilliant and glassy eyes, dilated pupils, quick pulsation of the carotids, no pulse at the wrist, relaxation of the muscles of the extremities, and rigid contraction of the muscles of the lower jaw. Cold affusion with stimulants, stimulating frictions, and emetics were employed. Vomiting was induced; the ejecta had a strong smell of prussic acid; and the child recovered. (Smith, in *Lancet*, June, 1844.) In a fatal case of poisoning by this oil, no odour was perceptible about the mouth when the body was found; but upon *inspection*, a powerful odour of prussic acid escaped from the cavities. All the viscera were in a healthy state. (*Med. Gaz.*, April 7, 1843.) The *vapour of this oil*, although it may cause vertigo or stupor, is not likely to produce death unless it be inhaled for a considerable time.

315. (*b*) *Laurel water—Cherry laurel water*—is a very weak solution of prussic acid, containing about a quarter of a grain per cent. of the strong acid. In large doses it produces the usual effects of prussic acid. *Cherry laurel* was formerly much used for flavouring liquours and sweetmeats. Almost every part of the plant is poisonous, especially the leaves and kernels, but the pulp of the cherry is not. *Cherry laurel*

oil is a weaker poison than the oil of bitter almonds, and contains about three per cent. of the anhydrous acid. COULLON relates an instance of the death of a child from the application of the leaves to a large sore on the neck. The distilled water and the oil of this plant are poisonous when introduced into the rectum, or into the cellular tissue, or injected into a vein, and when thus employed, or when swallowed, they occasion giddiness, palsy, insensibility, convulsions, and death; thus acting in a similar manner to the pure acid.

316. (*c*) *Peach flowers and kernels, and the fresh young shoots of the plant*, are poisonous. COULLON adduces two fatal cases of poisoning with *peach blossom*. But the effects are different from those produced by pure hydrocyanic acid, as the peach blossom acts more as an irritant of the digestive canal, and causes, in addition to insensibility and convulsions, efforts to vomit, and violent purging. A medical man swallowed half an ounce of a liquid prepared by digesting gin on a large quantity of *peach kernels*. He became giddy, and had violent constriction of the fauces, and dimness of sight. He vomited and recovered. (TAYLOR.) There are other plants which yield a distilled water and an essential oil containing more or less prussic acid; but as these are not used, at least in this country, I shall only refer to Dr. CHRISTISON's excellent work respecting them.

[We have in this country the *Prunus Virginiana* (wild cherry), *Prunus nigra* (black cherry), and *Prunus Caroliniana*, all containing hydrocyanic acid; besides the *Amygdalus Persica*, or peach (its kernels, leaves, and flowers), *Sorbus* (mountain ash), &c.

The leaves of the wild cherry are often poisonous to animals, as calves and sheep, and birds are intoxicated by its berries. An oil may be obtained by distillation from the bark, which proves extremely destructive to animal life. Mr. PRAETER, of Philadelphia, supposes this oil, when purified, to be identical with the *hydruret of benzale* (purified oil of bitter almonds) of LIEBIG and MOHLER, and that its deleterious properties are due to prussic acid alone. Children have been known to be poisoned by eating freely of the fruit of the wild cherry. The symptoms observed have been vomiting, stupor, dilated and insensible pupil, loss of strength, small and frequent pulse, pale skin, clinched jaws, inability to speak or swallow, and cold extremities. Aqua ammonia is one of the best remedies in these cases, with mustard cataplasms to the stomach and extremities. Birds are sometimes intoxicated by this fruit, and easily caught. The bark of the black cherry has proved poisonous in several instances when infused in cider. The kernels of the peach are often distilled for the purpose of impregnating *eau de noyeau*, which proves poisonous when taken in any quantity.]

317. *o. Treatment of Poisoning by Prussic Acid and its Compounds.*—(*a*) The remedy which is most efficacious in the treatment of the effects of these poisons is fortunately one which may generally be obtained without delay, namely, *cold water*, the *affusion of which upon the head, occiput*, and *nape of the neck* rouses the patient from his insensibility more rapidly than any other means. This treatment was first recommended by the author of this work in the *London Medical Repository* for July, 1825. It then attracted no attention, and was not even noticed by any of his contemporary editors. Dr. HERBST, of Göttingen, however, in 1828, three years afterward, recommended the same remedy, and the recommendation was then noticed in the British medical journals. The author, however, asserted his prior claims in the ninth and tenth volumes of the Medical Gazette. Dr. HERBST made several experiments on animals to show the efficacy of this treatment, which has now been tested in many cases in the human subject. It is, of course, the more successful the earlier it is employed; but as long as respiration and the heart's action continue, it should be resorted to and repeated according to its effects. The presence of convulsions, or of general palsy in addition to insensibility, should not prevent the administration of it. Indeed, convulsions and spasms may furnish grounds for hopes of success from it; and in cases where the insensibility and general palsy have been extreme, the occurrence of convulsions or spasms has been indications of commencing benefit. The water should be about the temperature of spring water; should be made to fall in a full and large stream upon the head—the vertex, occiput, and neck, and be repeated at short intervals, according to its effects, and in a similar way to that advised by the author for poisoning by opium. (See *Lond. Med. Repos.*, vol. xviii., and hereafter.)

318. (*b*) *Ammonia* has been considered by many as the most energetic antidote. It was advised by Mr. JOHN MURRAY, and may be employed by inhalation, or in any other manner, according to the state of the case. When given internally, the strong *aqua ammoniæ* should be diluted with twelve parts of water. It is most advantageously employed when the patient is roused, or even partially roused, by the cold affusion; and then the *inhalation* of the vapour of ammonia, if properly managed, is more efficacious than the ingestion of the remedy, which may not be accomplished, or even attempted, when insensibility, convulsions, and spasms of the muscles of the jaws are urgent.

319. (*c*) *Chlorine* has also been advised as an antidote for this poison by RIAUX, BUCHNER, SIMEON, COTTEREAU, and VALETTE. ORFILA considers it the most efficacious antidote of any hitherto advised. Unfortunately, the patient may be dead before the antidote can be procured in almost every instance in which it will be required. The excellence of a remedy will avail the patient but little when it cannot be procured, or when he is no longer capable of breathing or swallowing it when it reaches him, even when it has been procured with the utmost rapidity.

320. The means, therefore, upon which confidence may be placed are the cold affusion, the inhalation of the vapour of diluted ammonia, or of chlorine, when it can be obtained in time, and the ingestion of stimulants. As this poison is usually taken with a suicidal intention, an excessively large dose is generally swallowed; and this excessive quantity often precludes success from any of the means already mentioned, or from any other. The immediate evacuation of the stomach by the stomach-pump, or the administration of a zinc emetic, conjoined with cordials and stimulants, as cap-

sicum, &c., ought not to be overlooked. As this poison and its compounds cause congestion of blood within the cranium, blood-letting or cupping on the nape of the neck may prove most beneficial in some cases, where this effect appears most urgent, and the habit of body admits of this practice. But it should not be overlooked that blood-letting may accelerate the absorption of the poison; and therefore the stomach should be emptied in the first place, if it be considered that much of the poison still remains in it.

321. *H.* Zinc—Oxide of.—This substance is not productive of serious effects even when taken in large quantity. Owing to its insolubility, its absorption must be slow. When taken internally for a long time, it acts as a slow poison, and produces a *tabes sicca*. A gentleman, for the cure of epilepsy, took daily twenty grains of the oxide, until he had consumed 3246 grains, which must have been a course of five months' duration. At the end of this time he was pale, wasted away, almost idiotic, and the surface of an earthy hue. His tongue was thickly coated, the bowels constipated, the inferior extremities cold and œdematous, the abdomen tumid, the superior extremities cold and shrivelled, and the skin dry like parchment; and the pulse about sixty, thready, and almost imperceptible. Under the use of purgatives, a light, nutritious diet, and tonic and diuretic medicines, he rapidly recovered; but still remained subject to epileptic attacks.—(*Brit. and For. Med. Review*, July, 1838.)

322. *I.* The Vapours of Ether, [of Chloroform], and of Alcohol, when inhaled into the lungs until they are imbibed by the blood circulating in the bronchial surface and lungs, produce a paralyzing influence upon the cerebro-spinal nervous influence, the vapours of the ethers paralyzing or altogether suppressing sensibility; and the vapour of alcohol affecting more especially voluntary motion, or both voluntary motion and sensibility.* Owing to these effects, the consideration of these agents might have fallen under the present class; but I shall notice them more particularly under the *class of stupefying or narcotic poisons*.

323. Class III. Excitants—Stimulants—Exciting and Exhausting Poisons.—There are various substances which are simple excitants or stimulants, as respects either the nervous influence or vascular action, and which, when taken in moderation, are in no way injurious, unless a too frequent recourse be had to them. If, however, those be administered in excessive doses, they may produce injurious or even fatal results, owing either to excessive stimulation or to its consequences, especially exhaustion, congestion, effusion, and other changes in vital organs. Fatal effects, however, from most of the substances comprised in this class, are comparatively rare; and when they produce these effects, they operate more or less upon, or through the medium of the blood, and thereby seriously affect the functions of the brain, heart, and lungs. It is not improbable that certain excitants may act so energetically upon the nervous system, and, through them, upon the vitality of the frame, as rapidly to exhaust or destroy the influence of these systems, and vitality in all its manifestations. An intense electric shock, or lightning, may produce this effect; and we may conceive a shock from a galvanic battery of such violence as immediately to occasion the same result. In these cases the agent acts upon and through the medium of the nervous systems, although the blood and vascular system, and the muscular structures, may manifest the chief or only lesions.

324. i. Alcohol—*spirits of wine, spirituous liquors*, such as *gin, whisky, brandy, rum*, and *arrack*, have been taken in so large quantities as to produce not merely intoxication, but even death, in a few hours. The poisonous operation of alcohol has been ably investigated by Dr. Christison. In the article Drunkenness, I have described the slowly-developed effects and ultimate results of habitual drunkenness; and the articles Delirium Tremens and *Granular Degeneration of the* Kidneys are illustrations of certain other forms of slow or *chronic poisoning* by spirituous and other intoxicating liquors. It will be necessary for me, therefore, at this place to notice only the more *acute forms* of poisoning by alcohol and its compounds.

325. *A.* The *symptoms* of the more acute states of poisoning by alcohol are, violent excitement of the nervous functions, and of the passions or emotions; flushed face; excited vascular action, followed by giddiness; confusion of thought; various mental affections, varying with the character of the individual; delirium; dozing, passing into profound somnolency, which, after several hours, is interrupted by headache, sickness, vomiting, and terminates in a heavy or stupid headache, giddiness, or nervous exhaustion. Such is the more favourable course of severe intoxication; but a more unfavourable result may accrue, either during the stage of vascular excitement, or in the following period of congestion, the somnolency deepening into profound coma, terminating in death. Dr. Christison furnishes the following illustrations of this state of poisoning: Two brothers drank in half an hour three bottles of porter, into which twenty-four ounces of whisky had been secretly mixed by a companion in order to intoxicate them. In the course of drinking, both became confused; and fifteen minutes after finishing the last bottle one of them fell down insensible, and had no recollection of what happened for twelve hours; but he recovered. The other staggered a considerable distance for an hour, and then became quite insensible. In four hours he was comatose; the breathing stertorous and irregular; the pulse eighty, and feeble; the pupils dilated and not contractile, and deglutition impossible. He remained in this state till his death, which took place fifteen hours after this debauch.

326. In this state of acute alcoholic poisoning, an apoplectic tendency may be developed into a true *apoplectic seizure*; and the usual appearances of apoplexy be found within the cranium after death, this seizure occurring either in a simple form, or associated with paralysis, especially hemiplegia. This result takes place either during the somnolent stage—this state passing into profound coma—or a partial re-

[* We regard the effects of ether and alcohol, when inhaled in the form of vapour at least, as exactly identical, and both occasioned chiefly by the carbon and hydrogen which enter so largely into their composition, combining with the oxygen of the blood, thus substituting carbonic acid and water for the stimulating portion (oxygen) of the vital fluid.]

covery from somnolency occurs, and apoplexy, either gradually or suddenly, appears after the effects of intoxication have nearly or altogether passed off. An individual reached his home in a state of intoxication; he became lethargic, and died in the course of twenty minutes. On examining the body, Dr. Alison could not discover any morbid appearance, except some watery effusion in the ventricles and on the surface of the brain. The contents of the stomach had a strong smell of spirits. This case, however, presents a more rapid course than is usually observed when intoxication passes directly into coma and apoplexy. A man drank thirty-two ounces of rum in the afternoon, and was comatose most of the ensuing night. Next morning, although very drowsy, he was sensible when roused; and in the evening he was convalescent. But, two days afterward, he became delirious, and in two days more comatose and apoplectic. No other morbid appearances than congestion were found in the brain.

327. In some instances, the lethargy and insensibility caused by acute intoxication are attended by *violent convulsions*, which have presented either an hysterical or an epileptic form. I was called to a female who had drunk a large quantity of spirits in a short time. She was muscular and robust, violently convulsed, unconscious, and occasionally she uttered the most distressing screams. Recourse was had to the cold affusion on the head, the convulsions assumed more of the hysterical character, and the coma was diminished and soon ceased. In another case, also of a robust female, whom I attended with Mr. Lambert, convulsions of an epileptic character appeared during the insensibility caused by the ingestion of a large quantity of spirits. When I saw her the symptoms were exactly those of a violent epileptic attack, and, as in the former case, characterized by the strong smell of spirits. The convulsions continued for a long time, and then passed into violent phrenitic delirium, which was not removed for several days; but recovery, complete and lasting, followed cold affusions and copious local depletions. A medical student, after drinking four bottles of Champagne, during and after dinner, besides some other wines and liquors, became phrenitically delirious. Violent convulsions supervened and recurred at intervals, during which the phrenitic symptoms continued. I saw him about thirty hours after his debauch; the maniacal delirium, and the brief attacks of convulsions, recurred almost hourly, attended by the most intense indications of vascular determination to the brain and its membranes. The treatment about to be recommended was adopted, and he recovered.

328. *B.* A still *more acute state* of poisoning than the above, by alcoholic liquors, is sometimes met with. When these liquors are swallowed in large quantity, in a very short time, there is seldom much preliminary excitement. Coma occurs in a few minutes, and gradually assumes an apoplectic character. The face is livid or pale, sometimes ghastly; the breathing stertorous, and with a spirituous odour; the pupils dilated and insensible, sometimes contracted; and death often takes place in a few hours. Tetanic convulsions occasionally appear in this form, although not so frequently as in the preceding. Instances of this rapid form of poisoning have been recorded by Orfila, Bedingfield, Marx, and others. Dr. Christison mentions an instance of a man who drank at once a bottle of whisky. He died in four hours with symptoms of pure coma.

329. The effects of alcoholic liquors are greatly heightened, and often to a fatal extent, by exposure to cold either after or during the ingestion of the poison; and intoxication and insensibility more rapidly result. This is owing not only to the sedative influence of cold, but also to the partial or complete arrest of the excretion of the spirituous vapour by the lungs and skin. Most of the accidental deaths which have occurred in this country from exposure to cold during intemperate weather have been caused by a too free use of spirituous liquors just previously to such exposure, insensibility, coma, and death supervening.

330. Numerous instances have occurred, especially in this metropolis, of various liquors containing alcohol, especially malt liquors, having been made the vehicles of other poisons, and given with the intention of robbery or murder. The poisons thus administered have been usually opium or prussic acid, especially the tincture of opium. Such cases may be recognised by the fact that the effects are of a much more severe character than could result from the quantity of alcoholic fluid which had been taken. In these cases it is often very difficult to decide whether the symptoms are caused more by the alcoholic liquor than by the poison with which it was drugged.

331. *C.* The *appearances observed after fatal acute poisoning by alcohol* consist chiefly of increased vascularity of the internal surface of the stomach, sometimes with ecchymoses, the villous membrane presenting either a bright red, or a dark brown, or some intermediate hue; of congestion of the brain; of an increased quantity of fluid in the ventricles and between the membranes; and sometimes of effusion of blood in the substance of the brain, or between the membranes, or of a bloody serum in the latter situation. When death takes place rapidly, a strong odour of spirits may be perceived in the contents of the stomach; and in less rapid cases this odour has been said to have been perceived in the serum effused within the cranium; but this may not be felt if some time has elapsed before the inspection has been made. (*See art.* Drunkenness, § 8.)

332. *D.* The *quantity* required to destroy life cannot be determined. Much depends upon the age, habits, &c., of the individual, upon the state of the stomach, and upon the treatment. Young persons, not accustomed to spirits, may be killed by a comparatively small quantity. Mr. Taylor adduces the following: A boy, aged seven years, swallowed three ounces of brandy; shortly afterward he was observed to stagger. He was sent to bed, and vomited violently. In about four hours he was in a profuse perspiration, and his head, face, and neck were very red. Half an hour afterward he was found insensible, strongly convulsed, and the skin cold. He died in about thirty hours. Addiction to spirituous liquors often enables the system to tolerate a large quantity without much effect. A large, powerful young man, thus addicted, in the presence of the author

swallowed for a bet a bottle of rum within half an hour. He was hardly affected by it. A full stomach previously to the ingestion of spirits also affords a greater tolerance of this poison.

333. *E.* The *period* which elapses from the ingestion of the spirits until death occurs also varies with the circumstances just mentioned. Mr. Taylor states that the shortest period which he has seen reported occurred in a case of a man who swallowed a bottle of gin for a wager. In a quarter of an hour afterward he became intoxicated, and soon after that insensible, and died in *half an hour*, although a large quantity of the spirit had been removed by the stomach-pump. Dr. Chowne adduced an instance of a boy, aged eight years, who was found insensible half an hour after having taken about half a pint of gin. The liquid drawn off his stomach seven hours afterward had no odour of gin, nor was the odour of it perceptible in his breath. He was insensible and motionless; the limbs relaxed and powerless, the face pale, and the surface cold. The pulse was quick and feeble. He died, without rallying or recovering consciousness, *sixty-seven* hours after taking the poison. On *inspection*, the brain was found healthy. There were slight effusion of serum, and distention of the veins of the pia mater. The stomach was pale. No exact *period* can be assigned for the fatal termination of the effects of this poison, this termination depending chiefly upon the absorption of the spirit into the circulation, and upon the rapidity and extent of the absorption; the quantity accumulated in the blood, especially when the kidneys, lungs, and skin do not rapidly excrete it, suppressing the cerebral functions and impairing the irritability, and ultimately arresting the action of the heart.

334. *F. Treatment.*—The contents of the stomach should be withdrawn by the stomach-pump as speedily as possible; and the cold affusion ought to be resorted to immediately, in order to remove the symptoms of intoxication, or the insensibility or coma which may have already appeared. Previously to 1822, the treatment of dangerous cases of poisoning by alcoholic liquors, as well as those by narcotics, was not understood, and was certainly far from being successful. In July of that year, cases demonstrating the good effects of the cold affusion on the head in poisoning by these agents, were published by Mr. Wray and myself (*Lond. Med. Repos.*, vol. xviii.); and the efficacy of the practice in cases of poisoning by spirits has been vouched for by Dr. Ogston in an able memoir on intoxication. He states that, where the temperature of the head is steadily high, and that of the surface not much reduced, it is a safe and efficacious remedy.

[We have resorted to this treatment with the greatest success, by turning a stream of cold water upon the head from a pitcher for a considerable time; in this way vomiting will often be brought on, and the patient relieved from all symptoms of intoxication.]

335. Having removed the contents of the stomach and used the cold affusion, the liquor ammoniæ acetatis with the ammonia in excess should be freely given in camphor water. Cases are comparatively rare which admit of blood-letting or even of local depletions. In young, robust, and plethoric persons not accustomed to intoxication, and when the affection of the brain is of a phrenitic character, then vascular depletions are often required; but they should be resorted to with caution, and their effects carefully watched. When the insensibility and coma are profound, and when they resist the cold affusion on the head, the liquor ammoniæ acetatis, with the carbonate of ammonia and camphor water, should be given; and if deglutition cannot be effected, they ought to be conveyed into the stomach by the stomach-pump, or administered in enemata. Warmth, and the promotion of a free perspiration, are always beneficial. In other respects the treatment is the same as described in the articles Drunkenness, and Delirium with tremour; the more *chronic states* of poisoning by alcohol being there discussed, especially under the former of these heads.

336. ii. The Ethers—especially the *sulphuric*, the *nitric*, and *hydrochloric*—may occasion dangerous or fatal effects when taken in excessive quantity, or when their vapours are too long *inhaled.*—*A.* When taken into the stomach, the operation of the ethers is analogous to that of spirituous liquors. M. Orfila performed several experiments with them on the lower animals; but as these were accompanied with placing ligatures on the œsophagus, little importance can be attached to the results. I am not acquainted with any dangerous effects which have occurred from swallowing any of these ethers; and I believe that they may be taken in larger doses than they are usually prescribed, and be productive, in certain states of disease, of much benefit.

337. *B.* The *inhalation of ether*, especially the sulphuric, has lately come into vogue for the abolition of sensibility, in order that surgical operations may be performed with comfort, and even pleasure, to the patient. But it appears doubtful to me, after witnessing several instances of the inhalation of ether, whether or not the risks contingent on it do not more than compensate for the escape from pain during an operation.* The inhalation of ether to the extent of annihilating, even for a short period, the sensibility, must necessarily be attended by changes in the nervous system; and even in the blood, otherwise a most important function—and one presiding over and directing all our animal functions—could not be entirely subverted for a time; and it may be inferred *à priori* that congestions of the brain and medulla oblongata, congestions and inflammations of the bronchi and of the lungs, and alterations of the blood, especially as regards the red globules and fibrin, will result from the passage of so large a quantity of ether into the circulation as is usually required to produce insensibility; and I believe that these results have actually accrued already, in some instances, from the practice; and that, although matters may have

[* As ether has been employed thus far, we believe this remark perfectly just; but it remains to be proved whether ether may not be used, like other medicinal agents, with such prudence and caution that its benefits may preponderate over its evils. Its use, as well as that of chloroform, is at least justifiable, where, in severe operations, the danger of sinking, from the shock of the operation, is greater than that from inhaling these powerful agents—presuming, of course, that they prevent the shock, which is generally conceded. In the ordinary operations of dentistry and minor surgery, they should, in our judgment, be entirely abandoned.]

proceeded favourably as respects the operation, congestive bronchitis or congestive pneumonia has nevertheless been developed by it; while the absorption of purulent matter, and the occurrence of phlebitis, after great operations, have been favoured by it, by lowering the general amount of vital resistance, by affecting the constitution of the blood, and by weakening the tone of salutary vascular reaction.

338. The attempts recently made to introduce the *inhalation of ether* into general practice for the alleviation of the *pains of parturition*, as well as for trifling operations and unimportant occasions, are fraught with some danger; and I am confident that a farther experience will prove my predictions to be correct. I may here explicitly state what the danger is, as regards the *puerperal state*; namely, the supervention of *convulsions*, of *hæmorrhage*, *maniacal delirium*, *puerperal fevers*, sinking of nervous power in various ways, but especially in the form of cardiac *syncope*, and inflammations of the *respiratory organs*, or of the *brain*.

339. Instances were, a few years since, published of a druggist's maid-servant having been found dead in bed, owing to the air of her apartment having been loaded with the vapour of nitric ether by the breaking of a jar containing a large quantity of this substance. She was found lying on her side, with her arms folded across the chest, the countenance and posture composed, and her whole appearance that of a person in deep sleep. The stomach was found red internally, and the lungs were gorged. The brain was not examined. A young man was found completely insensible from breathing air loaded with sulphuric ether, and remained apoplectic for some hours. I am acquainted with an instance of similar effects having accrued, from the vapour of strong spirits having been inhaled while the person was transferring the contents of a large cask into bottles.

340. *C.* The *treatment* of insensibility caused by ether is not materially different from that produced by ardent spirits. The cold affusion on the head and neck is the most to be confided in, if the case be in any way alarming.

[To this should be added external revulsives, as mustard, &c., and internal stimulants in the form of ammonia, camphor, &c. Exposure to fresh air, and friction, are by no means to be neglected.]

341. iii. Camphor.—There are few substances the action of which is more variable, according to the dose, the mode of exhibition, state, and constitution of the patient, &c., than camphor. Hence its operation has been differently described, and its employment in disease has not been always judicious or beneficial. Having been in the habit of prescribing it, often in large doses, in various dangerous diseases, I was induced, on two occasions, to take a considerable quantity, in order to ascertain its effects from my own sensations; and on several other occasions I have taken smaller doses. These experiments were made chiefly in 1823 and 1824, and the results were published in the *London Medical Repository* for September, 1825.

342. *A.* The *vapour* of camphor is injurious to insects; and when long inhaled by man, it occasions headache, pallor of the countenance, slight irritation of the respiratory mucous surfaces, followed by slight reaction of the circulation, especially in the brain and lungs. *Locally*, on the *denuded dermis*, or on the *mucous surfaces*, it appears to impress the nerves of the part; and, after rendering the part at first pale, it increases capillary injection and redness, and develops moderate vascular reaction in it. Whether applied to the skin denuded of its cuticle, or taken into the stomach, or injected into the rectum or other mucous canals, camphor is readily *absorbed* into the circulation, and is eliminated from it chiefly by the lungs and skin, and not perceptibly by the urinary organs, although it is believed to affect those organs.

343. *B.* The *primary action* of camphor is exerted chiefly through the medium of the nervous system; but *consecutively*, and as it becomes *absorbed* into the circulation, its action is more fully manifested on the brain, on the heart and vascular system, and on the lungs, especially on the bronchial mucous surface, as it is eliminated by the respiratory organs from the blood. The following are the results of my experiments with this substance, above alluded to (§ 341).

344. Camphor produces effects varying with the dose, and the period which elapses from the administration of it. When taken into the stomach, triturated with oil, or divided minutely by means of mucilage, magnesia, &c., fifteen grains produce the effect of half a drachm given in the form of pills or bolus, or less minutely divided; and this latter quantity sometimes produces, especially when the stomach is empty, and taken in oil or much diffused in mucilages, &c., and in certain constitutions, very severe effects. Given, therefore, in doses of from fifteen to thirty grains, diffused in mucilage, it produces the following effects, which, as they are progressively different, may be divided into *three stages*.

345. *a.* In the quantity just mentioned, camphor occasions a peculiar sensation of heat and constriction in the throat, and along the œsophagus as it is swallowed, followed by a similar feeling, attended by slight anxiety, at the epigastrium and region of the stomach. The sensations of internal heat and of concentration or constriction in this situation continue for some time, and are attended by slight thirst, a more constricted and slightly accelerated pulse, and a colder state of the extremities. The surface of the body also becomes cooler, and a sense of chilliness and of coldness, greater than the actual loss of temperature, is produced; yet there is, at this time, a feeling of internal warmth and excitation, as if the energies of more remote parts were drawn towards the stomach. To these sensations are added pallor of the countenance, vertigo, pandiculation or slight rigours. The head is cool, the action of the carotids somewhat diminished, and the respiration slow or natural.

346. *b.* In from one to two hours, the constriction and diminished action of the surface and extremities have passed off, and replaced by more or less reaction and determination of blood to the head and periphery of the body. The pulse becomes fuller and stronger; animal heat is increased; the features are more de-

veloped, and the colour returns or is increased; the vertigo, pandiculation, chilliness, and rigours having disappeared. Shortly afterward, headache, flushed face, excited pulse, sometimes noises in the ears, various but slight affection of sight, watchfulness or slight mental excitement, or delirium and disturbed sleep, in some instances, are experienced.

347. *c.* These effects having continued a few hours, the excitement of the pulse and of the brain subsides; the heat of the skin passes into a free perspiration; the pulse becomes slower and softer, and a refreshing sleep terminates the headache and slight disturbance of the brain and organs of sense; and the nervous and muscular systems remain composed. These are the usual effects of a large dose (from fifteen to thirty grains) of this substance upon a healthy person, when it is not repeated. Where smaller quantities are taken every four, or five, or six hours, the effects constituting the second stage are chiefly manifested to an extent in proportion to the amount of the doses. When dissolved in oil or in spirits, it appears to act with greater activity, and to be more readily absorbed into the circulation, where, if the dose be large, or if the doses are repeated at short intervals, it acts energetically upon the nervous system, over-exciting the brain, and causing maniacal delirium, and even convulsions and death. It seems also to possess antiseptic properties.

348. *C.* The *smallest quantity* which has produced symptoms similar to the above, calculated by their severity to cause alarm, is *one scruple*. I have often, however, given this quantity, and repeated it a second and a third time at intervals of six and eight hours, with marked benefit, in low and malignant states of fever. When given in an enema, and in a state of minute division, it often acts with great rapidity, and sometimes with great severity. Dr. Christison adduces a case where half a drachm was thus administered, and severe nervous symptoms were produced. I have often prescribed as much as this, but never more, in an enema, for insensibility or profound coma, and either alone or with asafœtida; and it has sometimes been efficacious, but never injurious. In a case of most profound and protracted coma, in which deglutition was abolished, to which I was called with Mr. Kingdon and another practitioner, this substance, administered in an enema, in a very large dose, roused the patient, and procured ultimate recovery. Mr. Taylor adduces a case by Dr. Siemerling, in which a man, aged sixty-nine years, swallowed *two drachms* for the relief of rheumatism. Three hours afterward he resembled a drunken person. He complained of burning heat in the throat and stomach, of throbbings in the head, and pains in the course of the spine; of ringings in the ears, and dazzling light before his eyes. To these succeeded subsultus tendinum, and insensibility, and profuse perspiration. This last state was, however, of short duration; and he slowly recovered.

349. Dr. Wendt mentions a case in which eight scruples were taken dissolved in spirit, the *largest dose* hitherto mentioned. Vertigo, dimness of sight, delirium, and burning pain in the stomach, but no vomiting, were the only symptoms. The man who took this quantity was an habitual drunkard; but he recovered. I have often found that drunkards may take large quantities of this substance without producing any unpleasant symptom; and I have given it in very large doses (from ten grains to one scruple) with opium for the delirium of drunkards, with marked benefit.

350. *D.* The *appearances* occasioned by poisonous doses of camphor have not been observed in man. According to the experiments of Orfila and Scudery, the mucous membranes of the stomach, duodenum, and urinary organs were inflamed, and the membranes of the brain injected. The other appearances were less constant. All the cavities had a strong smell of camphor.

351. *E. Treatment.*—When the effects of camphor are not very severe, they soon pass off. But when they become alarming, whatever of this substance may still remain in the stomach should be removed by an emetic or by the stomach-pump, and demulcents with opiates, or henbane, or poppies, and the cold affusion on the head, or the shower-bath, ought to be resorted to, if maniacal delirium supervene. If convulsions or insensibility appear, the cold affusion, injections with asafœtida or ammonia, and other stimulants may he administered. If strangury occur, demulcents and emollient enemata are generally of the greatest service.

252. iv. Chelidonium majus and C. glaucium produce inflammation of parts to which they are applied; but they appear to he partially absorbed, and to act upon the nervous system, causing delirium in cases where they have been partaken of hy mistake. In M. Orfila's experiments, they occasioned remarkable congestion of the lungs, whether taken into the stomach or applied to wounds.

353. v. Heat, in its various forms and appliances, may be very briefly considered under the present category, as it may become more or less rapidly injurious, or even destructive of life.—*a. Atmospheric heat*, or the *temperature of an apartment*, may bc so high as to interfere with the respiratory functions; to impede the decarbonization of the blood; to excite, and ultimately to exhaust, the nervous energy; to change the state of the blood; and, lastly, to disorder all the excreting functions, and to arrest the vital actions. When, with a high range of temperature, the living hody is exposed to a stagnant state of the air, when there is not a sufficiently rapid renewal of the atmosphere, then the noxious effects are produced with a rapidity co-ordinate with the degrce of atmospheric stillness; and asphyxia is produced with proportionate celerity. But when the elevation of temperature is not so great, although still high, nor ventilation so imperfect, then the deleterious changes are less rapid, and assume a slow form, inducing various *chronic affections*, more especially of the liver, stomach, and bowels, and often also of the spleen. Fatty liver, various states of enlargement and chronic change of this organ, bilious fever, &c., are not infrequent consequences of this cause, and very frequently occur, even among the inhabitants of cold regions, who shut themselves up in close apartments, warmed by stoves, during the cold seasons.

354. It is important to remark, although the circumstance must be obvious, that the air, when raised to a high temperature by the usual means resorted to in factories—by heated air, by steam, or hot water transmitted through metal pipes to different parts of the building—readily becomes stagnant, and that due ventilation is with difficulty preserved in connexion with this mode of warming, although the great numbers of persons usually employed in these places require a more than usually rapid renewal of the air. The consequences are, that the persons there employed rapidly vitiate, or even poison the air which they breathe, independently of any deleterious miasm which may be generated by the articles, materials, apparatuses, or appliances used in these manufactories.*

355. *b. Warm Baths, Vapour Baths, Fumigating Baths.*—Medicated baths, and various natural *warm or mineral baths*, although beneficial when appropriately resorted to, may nevertheless become, owing to their exciting and exhausting influence, most deleterious in various states of the system, even in health, and still more so in several diseases. What is a most successful medicine when judiciously employed, becomes either a rapid or a slow poison when it is not appropriately prescribed.

356. Heat applied to the external surface in such excess as to produce scalds or burns, especially when an extensive surface is implicated, is productive of danger or death, not so much by the extent or severity of the local injury, as by the sympathetic development of inflammation of mucous or serous surfaces and its consequences.

357. *c.* The injury produced by swallowing hot or *boiling fluids* is dangerous or fatal, according to the amount or seat of local lesion. When the fluid is of a temperature as high as 200° or 212°, it rarely gets lower than the upper part of the gullet, and the injury is generally limited to the pharynx, epiglottis, and larynx. Accidents sometimes occur from drinking hot or boiling water from a teapot or kettle; and Dr. M. Hall has adduced the accounts of four such which occurred to children; and in all *cynanche laryngea* was produced. Two of these cases terminated by suffocation, one was relieved by tracheotomy, but died soon afterward, and the fourth recovered after having been nearly choked. (*Trans. of Lond. Med. and Chirurg. Soc.*, vol. xii., p. 1.)

358. vi. *A.* Ipecacuanha has been considered by some as an *irritant*, and by others as an *acro-narcotic;* but, strictly speaking, it cannot be viewed as either—not as an irritant, as it does not irritate or inflame the capillaries of the surfaces to which it is applied; nor as a narcotic, for it does not stupefy. Its impression is primarily upon the nervous organization of the part to which it is applied, and is rapidly followed by muscular contraction or reaction, when the quantity of the substance is such as to produce an impression sufficiently strong to develop this effect. The susceptibility of the influence of this substance is remarkably great in some persons—so much so as to occasion the most distressing effects. When this susceptibility is great, even the presence of a few grains of ipecacuanha in the same apartment as the person thus constituted is sufficient to produce a sense of suffocation, tightness in the chest, nausea, depression, or faintness, or other disorder, varying with the idiosyncrasy of the individual; but the most frequent affection is one resembling asthma. I have met with several persons who are thus affected by the odour of ipecacuanha, or by the impalpable powder of this substance, when any of it is inhaled; and seen two instances of most distressing suffering produced by it. It is not unusual, also, even when this susceptibility of the effluvium of the drug does not exist, to meet, in the course of medical practice, with persons upon whom very minute doses of any of the preparations of ipecacuanha produce more or less distress, especially nausea, retching, and depression.*

359. *B. Emetia* [*or Emetina.*]—The active principle, or alkaloid of ipecacuanha, whether taken into the stomach or applied to a wound, occasioned, in the experiments of Magendie, death after some hours, preceded by vomiting and coma, the lungs and stomach being found inflamed.

360. *C. Treatment.*—It is rarely that any thing more than time is required to remove the effects of ipecacuanha; for an over-dose of it is prevented from becoming injurious by its immediate rejection from the stomach. It is chiefly when, owing to idiosyncrasy, its more distressing effects are produced, that treatment is requisite. In the cases which I have treated, an open, free, and warm air, camphor with henbane taken in demulcents, and a warm mustard poultice applied over the lower part of the sternum and the epigastrium, soon removed the disorder. When nausea, retchings, and depression occur from small doses of this substance, or when the operation of it becomes exhausting or too prolonged, then small doses of ammonia and creasote, or this latter in an aromatic and emollient draught, will afford relief.

361. Class IV.—Exciting and Constringing Poisons.—*Nervous and Muscular Excitants.*—Although numerous medicinal substances act more especially upon both the nervous and the muscular or contractile systems, yet there are comparatively few of them which act so violently upon these systems as to produce death, unless they are employed improperly in the treatment of diseases, and aggravate existing morbid conditions, by interrupting the salutary efforts of nature, and by arresting or preventing the evacuation of hurtful or contaminating matters. Several substances, while they more or less excite the nervous and contractile tis-

* [The present mode of warming apartments by means of close and air-tight stoves is, for the same reason, highly injurious, and ought to be abandoned, and either the open grate, the Franklin stove, or fireplace substituted. In a late visit to the Massachusetts General Hospital, we were exceedingly gratified in finding cheerful fires in open fireplaces in the different wards, although the building is chiefly warmed by heated air. We were informed by Dr. Warren that, since open fires had been introduced, erysipelas, which was formerly a frequent disease in the hospital, had entirely disappeared. Wounds, also, sooner healed, and patients recovered more speedily from accidents and other diseases; puerperal females, also, had a more rapid convalescence, and altogether the effects were in the highest degree beneficial. We trust that the same mode of ventilation will be introduced into our other hospitals, and that more attention will be paid to the subject in all our public and private buildings, especially school-houses and churches.]

* [The late Dr. Uriah Turner of this city, a gentleman of high nervous temperament and great genius, and who was liable to severe attacks of asthma from inhaling the smallest quantity of the odour of ipecacuanha, fell a victim to an attack of this kind, induced by swallowing a few ipecacuanha pills by mistake.]

sues, become materially or chemically combined with the parts with which they are brought into contact, more especially with mucous membranes, by which they are readily imbibed. Tannin, gallic acid, and the gallates, krameria, alum, kino, catechu, solutions of several of the mineral salts, &c., while they excite nervous and contractile parts, and thereby produce a tonic effect, are partially imbibed by, or combined with, the tissues to which they are applied; and although this latter operation is not very manifest in the living textures, it is sufficiently demonstrated in dead animal matter, which is thereby preserved from decay for longer or shorter periods. The constringing influences of these and of similar substances are displayed more upon the exhaling and secreting surfaces to which they are applied than upon remote structures and organs; hut when the quantity is more considerable, or when the dose is often repeated, they are then more abundantly imbibed and absorbed into the circulation, and act more or less energetically upon the nervous centres and contractile parts. Most of these substances, however, are not poisonous unless they are taken in excessive quantities, or are employed inappropriately in certain states of disease.

362. But there are some of them which are among the most virulent poisons in nature, and are exceeded only by prussic acid in their poisonous influences. These substances act chiefly by exciting the nervous systems, the excitement being propagated to the spinal cord, and reflected thence upon the muscular system, the irritability of contractile parts being inordinately excited, and being followed by various consequences, according to the persistence or the exhaustion of the excitement, and to the parts more especially affected. These substances generally increase the sensibility, and in this respect chiefly they differ from narcotic or stupefying poisons. They do not paralyze or diminish muscular contraction, but, on the contrary, inordinately excite this function, so as frequently to become incompatible with the continuance of life, tetanic asphyxia being often the more immediate cause of death. They produce no visible change in the tissues to which they are applied, or in the alimentary canal; or, if any change is observed, it is accidental, not necessarily connected with the operation of the poison, and insufficient to account for any portion of the phenomena or symptoms they produce. They act chiefly by being absorbed, and through the medium of the circulation, upon the nervous centres, more especially upon the spinal cord; and they owe their activity to an alkaloid principle which is poisonous in an extremely small dose.

363. i. Alum.—*Sulphate of alumina and potash* can hardly be considered as a poison, although it may prove injurious when taken in very large quantity or in various disorders. It acts as an excitant and astringent, and is absorbed into the circulation; whence it is excreted chiefly by the kidneys. Its beneficial operation in lead colic is owing to its exciting the organic nervous and muscular structures of the digestive canal. M. Orfila has detected this substance in the stomach, liver, spleen, and urine.

364. ii. Nux Vomica—Strychnia, &c.—Several species of the genus *Strychnos*, namely, *S. nux vomica*, *S. Sancti Ignatii*, or St. Ignatius's Bean, *S. Colubrina*, *S. Guianensis*, *S. Tieuté*, which yields the *Upas Tieuté*, an Indian poison, &c., are extremely active poisons, and owe their activity to an alkaloid principle which has been called *Strychnia* or *Strychnine*. This substance has an intensely bitter taste, perceptible even when one grain is dissolved in 80 lbs. of water. It is sparingly soluble in water, but more abundantly in alcohol and the volatile oils. It exhibits an alkaline action, and forms neutral and crystallizable salts with the acids. Dr. Christison killed a dog in two minutes with one sixth part of a grain injected in the form of an alcoholic solution into the chest. He has seen a wild boar killed in the same manner with a third of a grain in ten minutes. There is little doubt that half a grain introduced into a wound might kill a man in a few minutes. It acts most rapidly and energetically when a solution of it is injected into a vein.

365. *A.* The *symptoms* produced by strychnia are uniform and striking, when this substance is applied in a large, poisonous dose. The animal is at first agitated, and is soon afterward seized with startings and stiffness of the limbs, which increase until it is attacked with a fit of violent general spasm, in which the head is bent back, the spine stiffened, the limbs extended and rigid, and the respiration checked by spasm of the respiratory muscles. An interval of calm succeeds, during which the sensibility is generally more than usually acute, and the senses unimpaired; but another paroxysm soon follows, each successive attack being more severe, and the invervals shorter, or less marked, until at length the severity of the fit, and the duration of the spasm of the respiratory muscles, terminate in suffocation. Dr. Christison has observed the first symptoms of this poison in from 60 to 90 seconds after the application of it to a wound; and 45 seconds after its injection into the pleura. MM. Pelletier and Caventou have seen them appear after 15 seconds, when injected into this cavity. M. Bouillaud says that it has no effect when applied directly to a nerve.

366. *B.* As to the *quantity* of strychnia likely to destroy life, much will depend upon the mode of application, and its administration in a dissolved or undissolved state. There is no doubt that one half, or even one third of a grain, when dissolved and injected into a vein, would be sufficient to destroy a man. Three eighths of a grain given medicinally produced violent tetanic convulsions, spasms of the extremities, trismus, opisthotonos, spasmodic contraction of the respiratory muscles, &c. Dr. Perrira has given the particulars of a case which favours the idea that strychnia, like digitalis, accumulates in the system, and suddenly occasions violent symptoms after the exhibition of it in small and frequently repeated doses, and which demonstrates the poisonous operation of this substance in man. A Swede, between fifty and sixty years of age, suffering from general paralysis, one side being more affected than the other, took one eighth of a grain of strychnia three times a day for some weeks, without effect. The dose was increased to one quarter of a grain thrice daily, also without effect. It was farther increased to half a grain, twice or thrice a day; and this dose was taken for some

days before the effects of this substance were manifested. The patient was found in a fit. The whole body was in a state of tetanic spasm; the trunk and limbs were extended; the shoulders thrown back; the muscles rigid and hard; the face and chest were of a purple colour; respiration had ceased, and the pulsation of the heart was very weak. Artificial respiration was imperfectly kept up by compressing the thorax; and the circulation was somewhat restored. The deep purple colour of the face went off. The man sighed, and the respiration returned; but the spasms very soon appeared with increased violence, and attacked the respiratory muscles. Respiration entirely ceased, the surface again became purple, but the circulation still went on. Artificial respiration was continued imperfectly, when the relaxation of the muscles would allow of it, but was this time ineffectual. The heart soon ceased to beat, and the purple colour of the surface was instantly replaced by the pallor of death.

367. A young man swallowed forty grains of strychnia. The symptoms commenced in a quarter of an hour. Trismus and spasm of all the muscles speedily appeared, and the whole body became as stiff as a board. The lower extremities were extended and stiff, and the soles of the feet concave. The skin became livid, the eyeballs prominent, the pupils dilated and insensible, and the patient lay in a state of universal tetanus. A remission occurred, but the symptoms soon became aggravated, and the patient died asphyxiated owing to spasm of the muscles of respiration, in about an hour and a half after taking the poison. On inspection, twenty hours after death, the body was very rigid. There was affusion in the spinal sheath [probably only the spinal fluid], and the upper part of the spinal marrow was softened; the brain was congested, but the alimentary canal was in its normal state. (*Lancet, Jan.* 27, p. 647, 1838.)

368. Mr. French informed Mr. Taylor that a person took a grain of strychnia at a dose. Vomiting occurred, and no ill effects were produced; but half this quantity may give rise to dangerous symptoms, when taken for the first time. When commenced with in small doses and gradually increased, the system may become gradually habituated to its influence, until a large dose is reached, when its effects may be suddenly and fatally manifested, as in the case mentioned above (§ 366).

369. The operation of *strychnia*, or of its *salts*, or of any of the substances which contain this poison, should not be mistaken for *tetanus*. This disease is developed much more slowly, and death takes place after a much longer time, than in cases of *acute* poisoning with any of these poisons. But if the dose be small and frequently repeated, a much less acute form of poisoning may be produced, and one which may, with great difficulty, be distinguished from tetanus. An attempt was made to defraud insurance offices in London, by insuring the life of a young woman very largely, and destroying her by administering strychnia in porter.

[Dr. W. C. Warner, of Bristol, Vt., died suddenly at Montpelier, October 11, 1846, aged 39, while attending the Legislature, from taking about one fourth of a grain of strychnia. In less than five minutes he felt a constriction of the throat and tightness of the chest, with rigidity of the muscles, on attempting to move. He complained of want of air, and requested the window to be raised. He was immediately seized with a tetanic convulsion, in which his head was drawn back, his countenance became livid, fluid matters issued from his mouth, with frequent moans; the palpebræ constantly in motion. The first paroxysm lasted some five minutes, which was succeeded by an interval of partial calm, during which it was difficult for him to articulate with distinctness. He made several efforts to vomit, by exciting the fauces with his finger: there was such constriction about the throat as to prevent swallowing. This interval lasted about five minutes, when another paroxysm succeeded, by a little starting and stiffening of the extremities, and immediately the whole body was thrown into a tetanic spasm, which lasted two or three minutes, when life was extinct, in about 14 minutes from the time of swallowing the poison. The intellect remained clear to the last.—(*Bost. Med. and Surg. Journ.*)

In one case, where we recommended strychnia endermically, one third of a grain, applied to a blistered surface, nearly proved fatal; the patient, a stout man, being thrown into violent tetanic spasms, which lasted, with intervals, for more than two hours.]

370. *C. Nux Vomica*, the *Bean of St. Ignatius*, the *Upas Tieuté*, the *Wourali poison*, and the other substances enumerated above (§ 364), owe their poisonous properties to *strychnia*. St. Ignatius's bean is said to contain nearly three times the quantity of this alkaloid found in nux vomica. But this last substance is most frequently employed as a poison. The symptoms produced by it are similar to those caused by strychnia, but are less severe. Nux vomica is usually taken in the form of powder. It has an intensely and persistent bitter taste; and generally tetanic spasms appear in from five to twenty minutes after it has been taken. The symptoms are altogether the same as have been described, and death is produced by the asphyxia consequent upon the spastic contraction of the thoracic muscles.

371. Mr. Baker states that *nux vomica* is taken by many of the nations of Hindostan habitually, generally night and morning, beginning with an eighth part of a nut, and gradually increasing the dose to an entire nut, or about twenty grains. If it be taken immediately before or after a meal, it never occasions any ill effects; but if this precaution be neglected, spasms are apt to ensue. As this substance is taken in a state of coarse powder, and not in greater quantity than one nut, and frequently after having been half roasted, it is probable that it is only slowly acted upon by the juices of the stomach; and that the modifying influence of habit as regards it is not considerable. Mr. Baker adds that is is thus used as a preservative from lepra and some other chronic disorders; but it is more likely that it is taken on account of its tonic and aphrodisiac properties. The habitual use of this substance proves that the cumulative influence imputed to it above does not exist. (*Trans. of Med. and Phys. Soc. of Calcutta*, vol. i., p. 140.)

372. *D.* As *nux vomica*, in *powder*, in *extract*, and in *tincture*, is an excellent remedy in several

disorders, and is frequently used medicinally, the *symptoms* indicating its injurious operation should be more fully described. When large doses are given, the stomach often becomes disordered, the appetite impaired, and the bowels constipated. The muscular system and the sensibility are next affected. All the senses are more than usually acute. The sensibility of the surface to cold, or to slight touch, is remarkably acute; and depression of spirits, anxiety, and a feeling of weakness and weight in the limbs are complained of. Mr. Pereira remarks that the limbs tremble, and slight rigidity or stiffness is felt upon motion. The patient staggers, and, when he stands, a slight tap on the ham brings on a convulsive motion, which nearly throws him down. If the medicine be persevered in, these effects increase, and the voluntary muscles are thrown into a convulsed state by very slight causes. The sudden contact of external bodies acts like an electric shock upon him, and produces a convulsive paroxysm. A deep inspiration, turning suddenly in bed, startling sounds, &c., have a similar effect. The farther use of nux vomica renders the symptoms still more intense; the fits of spasm now occurring spontaneously, and without any of these provocations. It acts upon the bladder and genital organs, and exerts an aphrodisiac effect on both sexes. The pulse, however, is but little increased in frequency, and is sometimes calm even when muscular rigidity has appeared. Preceding and accompanying these effects, great sensibility of the surface, painful formications, and acuteness of the senses are experienced. The intellectual powers are unimpaired. If the use of this substance be continued, especially in an increased dose, the symptoms are still more violent, and tetanus, tetanic asphyxia, and death succeed each other with great rapidity, as they follow large doses of *strychnia* (§ 365).

373. *a.* Dr. Christison states the smallest *quantity* of nux vomica likely to produce death to be three grains of the alcoholic extract; which is not so small a dose as fifteen grains of the powder, which was fatal in a case adduced by Dr. Trail. Thirty grains, taken in two doses, caused death; and fifty grains (equal to a quarter of a grain of strychnia) were fatal in an hour.

374. *b.* The *period* after the ingestion of the poison at which death usually occurs is generally from one to two hours, but Dr. Christison mentions a case that terminated in fifteen minutes. When this poison destroys life within a few hours, or in still shorter time, vomiting rarely occurs, and the patient dies from the tetanic asphyxia. But when death does not take place thus suddenly in a fit of spasm, the person continues to be affected for twelve, or eighteen, or twenty-four hours with similar or milder paroxysms, and may expire from exhaustion, or entirely recover. A fatal termination by exhaustion is not, however, so frequent as that by asphyxia. M. J. Cloquet met with a case of fatal exhaustion consequent upon the violent and repeated spasms produced by this substance. The tetanic fits returned for more than twenty-four hours, the sensibility being very acute. Death did not take place until the fourth morning. (*Nouv. Journ. de Med.*, t. x., p. 157.)

375. *c.* There are several instances of *recovery* on record. Sobernheim states that a young man took half an ounce of this powder, and experienced the usual symptoms. After the administration of emetics he recovered. Dr. Bassedow has recorded a similar case, recovery following the operation of emetics. Mr. Baynham states that a girl swallowed half an ounce of the powder; the usual symptoms appeared, but the treatment having been prompt, they subsided in about four hours from their first appearance, and the next day she was only feeble and exhausted. He says that he has often prescribed a scruple of nux vomica three times a day without any ill effects! In this, as well as in other cases, there was neither vomiting nor purging until they were produced by the treatment. A strong dose of sulphate of zinc caused free vomiting in a few minutes. (*Lond. Med. Gaz.*, vol. iii., p. 445.)

376. *E. Appearances after Death.*—These vary with the rapidity with which death takes place, and the period after death at which the body is examined. In a case recorded by Mr. Ollier, death took place in an hour, and the changes were slight. The stomach was almost natural, although between two and three drachms of the powder of nux vomica had been taken. The vessels of the brain were somewhat congested; the heart flaccid, empty, and pale. In a case which was rapidly fatal, detailed by M. Ollivier, and examined by him and Orfila, the body was found remarkably rigid, although not less than forty hours had elapsed since death. The more depending parts of the external surfaces were purplish. Much serous effusion was found on the surface of the cerebellum, and softening of the whole cortical substance of the brain, but especially of the cerebellum; this case confirming the opinion of Flourens, that nux vomica acts especially on the cerebellum. The lungs were congested with black fluid blood. (*Archives Génér. de Med.*, t. viii., p. 18.) In a case mentioned by Mr. Taylor, a quantity of the powder was found in the stomach, to the internal surface of which it adhered tenaciously. The vessels of the brain were congested. No other changes were noticed. The spastic contraction of the muscles seems to pass into the state of cadaverous rigidity after death, without intermediate flaccidity.

377. *F. Treatment.*—The most efficacious treatment of poisoning by the substances containing strychnia is an immediate recourse to the stomach-pump, and, if this apparatus is not at hand, to the more powerful emetics. Dr. Christison remarks, that, when nux vomica in powder has been taken, it adheres tenaciously to the inner surface of the stomach, and that the means used to evacuate the stomach should therefore be assiduously continued. Emetics may not act, as in Mr. Ollier's case, therefore they ought not to be solely confided in. If the patient be not attacked with spasms in two hours, he may be considered likely to recover. In cases of poisoning with *strychnia*, the efficacy of any treatment is very doubtful, for the quantity which is poisonous is so small, and its absorption so rapid, that means must be instantly resorted to in order to be efficacious. Dr. Christison quotes M. Donné, who states that he has found iodine, bromine, and chlorine

to be antidotes for poisoning with this, as well as the other vegetable alkaloids; these substances, he says, forming, with the alkaloids, compounds which are not deleterious, and which, being in chemical union, are not readily decomposed. Animals, he states, which had taken one grain of strychnia, or two grains of veratria, did not sustain any harm, when tincture of iodine was administered immediately afterward; but the delay of ten minutes in the administration of the antidote rendered it useless. Farther evidence is required as to these antidotes. Dr. Pereira remarks, that probably astringents, as infusions of galls, green tea, &c., would be serviceable. To relieve the spasms, narcotics may be employed. Sachs and others have recommended opium. As conia is the counterpart of strychnia, it deserves a trial. Dr. Pereira applied it to a wound in a rabbit affected with tetanus from the use of strychnia; the convulsions ceased, but the animal died. In the absence of conia the extract of hemlock may be tried. To relieve the symptoms consequent upon the endermic application of strychnia, acetate of morphia applied to the same part has given relief. (Pereira, Op. cit., p. 1306.) In a case in which I pushed strychnia so far as to occasion severe spasms, spirits of turpentine were applied with tincture of opium in the form of an embrocation along the spine, and were administered in enemata with asafœtida, and the spasms very soon disappeared.

378. iii. Brucia—*Brucia Antidysenterica*, or *false Angustura Bark*.—This vegetable alkaloid causes symptoms of the same kind as strychnia. According to Andral, brucia is twenty-four times less powerful than strychnia; but the bark itself appears to be nearly as strong as nux vomica. Professor Marc took an infusion of this bark in mistake for true Angustura; and, although the dose was only three fourths of a wineglassful, yet he was seized with nausea, pain in the stomach, giddiness, sense of fulness in the head, ringing in the ears, stiffness of the limbs, pain on every attempt at motion, locked jaw, difficult articulation, &c. These symptoms continued two hours, and abated under the use of ether and laudanum. Dr. Emmert states, that a boy who died from taking this poison experienced so distressing a state of sensibility in the intervals between the spasms, that he begged not to be touched, as he was thereby thrown into a paroxysm. This physician has investigated the operation of this poison, and he believes that it acts directly on the spinal cord, and not through the intervention of the brain. In his experiments division of the medulla oblongata, artificial respiration being kept up, or division of the spinal cord, did not prevent the effects of the poison from being manifested in the parts supplied with nerves below the division. The *symptoms* and *treatment* of this poison are the same as those of strychnia, and of the substances which contain it. There are few other substances which are productive of death by operating in such a manner as to bring them under the present category; but the *Cocculus Indicus* and the *Coriaria myrtifolia* appear to possess properties in many respects similar to the foregoing. [The *Rhus toxicodendron*, and some of the other species, possess tetanic properties similar to those of strychnia and brucia.]

379. iv. Cocculus Indicus.—*The Berries or Fruit of the Anamirta Cocculus*.—Cocculus Indicus is poisonous to all animals. It acts on the cerebro-spinal nervous and muscular systems, causing tremblings, staggering, tetanic convulsions, and death. It does not appear to increase the sensibility; and the coma observed is rather the result of the exhaustion of vital influence by it, than of any narcotic property, which is only produced when the dose is large, and at an advanced period of its operation. Orfila says, that this poison acts like camphor on the nervous system, and principally on the brain. M. Goupil states, that it communicates its poisonous properties to fish, which have been killed by it, and more especially to barbel. It is frequently added to malt liquors for the purpose of increasing their intoxicating powers. Its active principle has been called *Picrotoxine*. Dr. Pereira observes that, from accounts he received from an excise officer, the action of this poison is exerted more upon the voluntary muscles than upon the intellectual powers; and that, notwithstanding the severe prohibitory statutes against the employment of Cocculus Indicus in brewing, there is every reason to believe that it is extensively used; but a solution of the extract being employed, the detection of it is rendered very difficult. Morrice, a writer on brewing, directs three pounds of Cocculus Indicus to be added to every ten quarters of malt. "It gives," he says, "an inebriating quality, which passes for strength of liquor, and prevents second fermentation in bottled beer, and consequently the bursting of bottles in warm climates:" pleasant information this for those who indulge in these liquors; and satisfactorily accounting for the injurious operation of them on the human frame. According to Wepfer and Orfila, this substance in poisonous doses exhausts the irritability of the heart.

380. The *treatment* of poisoning by *Cocculus Indicus*, or by *picrotoxine*, consists in the prompt removal of the poison from the stomach, and in having recourse to the means advised for the effects of nux vomica (§ 377).

381. v. Coriaria Myrtifolia possesses properties similar to the foregoing. It is frequently found as an adulteration of senna. According to Professor Mayer, it produces violent fits of tetanus, followed by apoplectic coma. A grain injected into the jugular vein of a rabbit occasioned in about five hours a single convulsive paroxysm, which proved immediately fatal. Sauvages has recorded two cases of death caused by the berries. M. Fee has adduced five cases of poisoning, owing to the adulteration of senna with this substance; and one of them proved fatal. The symptoms were violent convulsions, locked jaw, and colic. M. Roux also published, in an interesting memoir, three cases which came under his own observation, one of which proved fatal; the symptoms being sparkling and rolling of the eyes, locked jaw, loss of voice, convulsions recurring in paroxysms of the duration of eight or ten minutes, and death after sixteen hours. Of those fatal cases the membranes of the brain, on *dissection*, were found congested in one, no other change being observed; the internal surface of the stomach and bowels was injected

in another; and in the third no alteration could be detected. The *treatment* for poisoning with this substance does not differ from that recommended for the substances containing strychnia (§ 377).

382. Class V.—Irritating and Depressing Poisons.—*Irritating and Paralyzing—Acro-Sedatives.*—Although this class of poisons is more or less allied to the third and fourth classes, and not less so the sixth and eighth, still it is distinct from all of them: 1st, in the alterations of function and structures produced by it; and, 2d, as respects the treatment required to remove these alterations. The substances ranged under this class not only affect the nerves of the part to which they are applied, but irritate them, and excite more or less of morbid action of the capillaries. In conjunction with this local action, they are more or less imbibed by the membranes, and absorbed into the circulation, thereby affecting, each with modifying influence, the vital manifestations of the systems and organs of the body. Their general operation, when administered in very large or poisonous doses, is to irritate the tissues with which they come in contact, and to depress vital power throughout the frame, or to paralyze the functions of certain organs or parts. The irritating action they exert locally is extended, especially as respects some of them, to adjoining viscera; and this action is also exerted in those excreting organs which eliminate them from the blood, although often very slightly or inappreciably. But it is rare to observe after death evidence of irritation and its consequences to such an extent as to account for the fatal issue; and therefore we are induced to infer that, although these changes may have aided in producing this result, the depressing influence exerted upon the nervous systems, and upon the vitality of the frame in general, by this class of poisons, is that to which their fatal operation is mainly due. Even in those cases in which evidence of irritation, and the changes consequent upon this condition, are the most remarkable, although death may, according to the views of some, be ascribed chiefly or altogether to those changes, still they are insufficient of themselves to account for the rapidity of this issue, especially when they are compared with the extensive disorganizations observed after the more corrosive poisons, whose action is strictly local, and which often do not cause death until after prolonged periods of suffering.

383. 1. Aconite—*Monk's-hood—Aconitum napellus.*—*Aconita*—*Aconitine*—*Aconitina.*—According to the observations of Dr. Fleming, the species *napellus*, and its varieties, are the most poisonous of the genus. The amount of numbness and tingling felt on chewing the root indicates the respective activity of the various species; the power of exciting these sensations residing in the aconitina, which the plant contains. The most active officinal preparations are the tincture and alcoholic extract; but all parts of the plant are poisonous, this property residing in the *aconitina*, the alkaloid discovered in Aconitum napellus by Geiger and Hesse. Cases of poisoning by this plant are not frequent. I have seen only one instance; but injurious effects have followed, although rarely, from a too large dose of the tincture. The expressed juice and the officinal preparations are most rapidly fatal when injected into a vein, or into a recent wound. They are also injurious in smaller quantity, and with greater rapidity, when introduced into the serous cavities, or in the cellular tissue, than when taken into the stomach; and they are poisonous, also, when introduced into the mucous canals.

384. *A.* Applied *locally*, aconite produces very slight irritation of the tissues; but it often excites a sense of heat. It hardly occasions any visible change of the part. On the nerves it acts as a local sedative, especially to the nerves of sensation, occasioning numbness and tingling. The loss of sensibility is followed by impairment of muscular contractability and irritability. It does not appear, according to Dr. Fleming's experiments, to produce dilatation of the pupil; and he states that the topical application of the poison is unaccompanied by pain, redness, or swelling, even when the physiological and remote effects are produced to the greatest extent; the peculiar sensations caused by chewing the root being unattended by any inflammatory irritation.

385. *B.* The *remote* or constitutional operation of aconite depends upon the absorption of it, as shown, 1st, by the rapidity and intensity of the remote action being in proportion to the absorbing powers of the part to which it is applied, and to the facility with which the preparation employed is capable of being absorbed; 2d, by the circumstance of no remote effects, or but slight effects, being produced when it is applied to the sound skin, although the topical action indicates that the nerves were affected by it, in the manner above stated. Being imbibed and absorbed into the circulation, it acts upon the nervous system, and more especially on the cerebro-spinal nervous system; impairing the sensibility and the functions of sense, and diminishing the power of muscular action. It seems also to impair organic nervous influence and irritability, proving a sedative of the cardiac and vascular actions, and reducing, as shown by Dr. Fleming, the strength, volume, and frequency of the pulse more or less, according to the dose. This antiphlogistic or sedative operation of aconite has been fully evinced in various diseases for which I have prescribed it. It is of importance to determine whether or no the frequent or continued exhibition of this substance produces a *cumulative action.* Although I have often prescribed aconite, yet I have not had reason to believe that this action has ever occurred. Dr. Fleming, however, states that two individuals were affected with general tremours, severe pain in the head and eyeballs, constant lachrymation, intense photophobia, heat of skin, quick pulse, and great restlessness, symptoms which were distinctly attributable to the continued use of this substance.

386. *C.* The *symptoms* produced by poisonous doses of the aconite are, a sense of warmth in the stomach, with a numbness and tingling, and feeling of distention of the tongue and lips, sometimes with slight nausea, followed by vomitings or retchings. The countenance becomes pale and sunken, and muscular power prostrated. The senses are impaired, but consciousness remains, or slight wandering delirium appears. Some persons feel as if they were dying

or sinking. The voice is whispering or lost; the respiration weak and superficial; the pulse weak or slow, small or irregular. The surface is cold, and covered with a clammy sweat. At a more advanced period the patient becomes speechless, deaf, and blind. The pupils are at first contracted; but afterward, sometimes general muscular tremours or slight convulsions supervene; the pulse, at first slow, becomes imperceptible, the coldness of the surface and extremities increases, and the patient dies from syncope. In a case in which I was consulted, petechial ecchymoses appeared on the surface of the body and on the face, and marked congestion of the brain occurred with hemiplegia, yet the patient recovered, the palsy having nearly disappeared when I saw him some years afterward. In most cases, especially when any part of the plant has been ate by mistake, heat, sense of constriction, numbness and tingling in the mouth and throat are the first symptoms complained of. Vomiting or diarrhœa is generally present, with swelling of the abdomen. A lady was poisoned by eating the root in mistake for horseradish with roast beef. She could not thus have taken much of it; but shortly afterward slight vomiting, with abdominal pains, came on, and although emetics, &c., were used, she died in three hours.

387. The symptoms may appear immediately after taking the poison or not for one or two hours, the delay being owing to the part and state of the plant taken, and to the presence of food in the stomach. Five grains of the fresh extract of aconite were given to each of three patients in the hospital at Bourdeaux. In a quarter of an hour after taking the poison, they had tremours of the muscles, a pricking sensation over the body, and severe vomiting followed. They became unconscious; and on recovering their senses they complained of confusion of sight and intense headache. The pulse was slow and irregular, the respiration short and hurried; the skin was cold and clammy. Two of the patients recovered. Dr. Geoghegan adduces two cases, one of which died in an hour and a quarter after eating the root, and the other in two hours. One drachm of the root has proved fatal, but it is probable that less than this would kill an adult. Dr. Male died from the effects of not more than eighty drops of the tincture taken in ten doses, over a period of four days, the largest quantity taken at once having been ten drops.

388. *D.* The alkaloid, *aconitine*, is the most virulent poison known, exceeding even prussic acid. One fiftieth part of a grain of aconitina proved nearly fatal. Its operation and effects are altogether the same as those of aconite, only much more intense.

[A case of poisoning by *aconitina* has recently been reported by Dr. Golding Bird, of London (*Med. Gazette*), which, from its interesting nature, we present to the reader. It is the first case of the kind, we believe, ever published, although there are several on record where the roots and leaves of the aconite have accidentally produced death. There are few agents, Dr. Bird thinks, more likely to be employed by the secret poisoner, with greater certainty of escaping detection, than aconitina.

A gentleman of high intellectual attainments, and holding an important position in society, swallowed intentionally about two and a half grains of *aconitina*. From collateral evidence, it appeared probable that almost immediately after having taken it, he must have fallen and struck his head a severe blow against some furniture in the room. The poison, or the blow, or both, produced violent vomiting, as the room was flooded with vomited matter. Dr. Bird saw the patient about eight hours after taking the poison. The patient was then fearfully collapsed; the surface cold and sweating; quite pale; the heart's action scarcely perceptible; pupils sensible to light; no paralysis either of sensation or motion; intellect unimpaired. The most prominent symptom was incessant and severe vomiting of a brownish fluid. This vomiting was, however, peculiar, and perhaps hardly deserved that title, the patient being really seized with a kind of general spasm, during which he convulsively turned on his abdomen, and with an intense contraction of the abdominal muscles he jerked out, as it were, the contents of the stomach, with a loud shout, depending, apparently, on the sudden contraction of the diaphragm. These exhausting and distressing symptoms occurred every minute or two. On attempting to make him swallow any fluid, a fearful spasm of the throat took place, producing the distressing effects so well known in hydrophobia; this was not produced by the sight of water, but the convulsive movements of the body, and emptying of the stomach, were excited by abruptly touching him. He was placed in a hot bath, and afterward removed to bed, covered with blankets, and a large mustard poultice to the sorbiculus cordis, and an enema of turpentine administered. He remained in much the same state, the sedative effects of the aconitina on the heart gradually lessening, so that in the course of seven hours the pulse became perceptible, though very weak; the hydrophobic symptoms were, however, then produced by every attempt to swallow, so that none of the medicines suggested could be made use of. Enemata of beef tea, and yolk of egg, with ten drops of laudanum, were administered, with the view of affording support and quieting the patient. He passed a dreadful night of exhaustion and spasm; intellect perfect, and even vivid, so as to astonish the by-standers. By two o'clock the following day the poison had so far ceased to operate, that the patient was regarded as convalescent.

The *aconitina* must in this case probably have nearly all been discharged by vomiting, and yet most violent effects followed. Dr. Bird seems inclined to believe that the convulsive vomiting and imperfect hydrophobia are characteristic of the effects of this poison, differing, however, from the effects of aconite root, with the exception of the sedative influence on the heart. This, however, is in accordance with a fact well known, viz., that a pure alkaloid often differs materially in its physiological action from that of the plant from which it is obtained, as in the case of the alkaloid *conia*.]

389. *E. Death* is produced by aconite owing to the sedative influence caused by it on the nervous system, or to its paralyzing effect upon the muscles of respiration, or to the impaired irregularity of the heart, fatal syncope supervening. The death of the human subject takes place generally by syncope, which sometimes

occurs suddenly, unexpectedly, and immediately: the fatal sedative and paralyzing influence of the poison on the nervous system appearing chiefly in experiments on the lower animals, when the dose of the poison has been very large.

390. *F. The appearances on dissection* have been very imperfectly observed. Venous congestion, to a greater or less extent, has generally been found. In some instances, engorgement of the brain and membranes, with considerable sub-arachnoid effusion, has been met with. In the cases recorded by Pallas, Degland, and Geoghegan, inflammatory appearances were present in the alimentary canal. The lungs were generally congested, and the blood very dark.

391. *G.* The more *diagnostic* or characteristic phenomena produced by this poison are numbness and tingling of the mouth and throat, or parts to which it is applied; vomiting or retching, with tumefaction of the abdomen, numbness, tinglings or tremours of the extremities, contraction of the pupils, slowness or failure of the pulse and of the heart's action, and death from this last change.

392. *H. Treatment.*—If retchings only have occurred without free vomitings, an emetic, consisting of sulphate of zinc with capsicum, or of mustard mixed in water, should be administered. If the poison have passed into the intestines, or sufficient time have elapsed for this to have taken place, warm purgatives and enemata should be resorted to. Stimulants, as warm brandy and water; camphor or ammonia, with capsicum, and small doses of opium; sinapisms or terebinthinated embrocations over the epigastrium, or along the spine; strong coffee, and frictions of the surface, are the means chiefly to be confided in.

393. ii. Arsenic.—*Arsenious Acid—Arsenic and its Compounds.*—Of all the varieties of death by poison, none is more important, as Dr. Christison remarks, than poisoning by arsenic. The facility with which it as well as all other poisons may be procured in this country, and the ease with which it may be secretly administered, lead to its adoption for the purpose of murder. It is fortunate, therefore, that there are few substances, and hardly any other poison, which can be detected in such minute quantities, and with so great certainty, according to the full and minute directions which will be found in the works of Orfila, Paris, Beck, Christison, Devergie, Pereira, Taylor, Guy, and others. The *compounds* of arsenic met with and employed in the arts, and by which life may be destroyed either accidentally or intentionally, are, 1. The *protoxide* of *Berzelius*, or *fly-powder*; 2. *Arsenious Acid*, or *white arsenic*; 3. The *Arsenite of Copper*, or *mineral green*; 4. The *Arsenite of Potass*, or *Fowler's solution*; 5. The *Arseniate of Potass*; and, 6. The various *sulphurets*, pure and impure, as *Realgar*, *Orpiment*, and *King's yellow*. Of these, *arsenious acid*, or white arsenic, is that most frequently administered as a poison. Mr. Taylor states, that in 1837 and 1838 there were 185 cases of poisoning by this substance in England, the greater number of which were cases of suicide and murder.

394. White arsenic possesses a very feeble acid reaction, although it combines with alkalies. It has, in small quantity, hardly any taste, and hence the frequency and risk of its employment. It is sparingly soluble. Cold water dissolves from half to one grain to one fluid ounce of water; and boiling water allowed to cool upon the powder dissolves a little more than one grain to the ounce of water. Mr. Taylor states that the presence of organic matter in a liquid diminishes the soluble power of the liquid. Viscid or mucilaginous fluids, of course, suspend the finer parts of the powder of this substance. The solubility and action of arsenious acid are said to be increased by admixture with nitre. This writer states that a teaspoonful of powdered arsenic weighs about 150 grains, a table-spoonful 530 grains, and a pinch about seventeen grains.

395. *A. Symptoms.*—Arsenic, *taken into the stomach*, produces different *forms* of poisoning, according to the quantity and state of the poison, as respects admixture, &c., and to the state of the stomach and constitution of the individual, according to the various modifying circumstances already mentioned (§ 51, *et seq.*). The *forms* of poisoning thus resulting are, 1st. *Acute*; 2d. *Chronic*; and the acute assumes two varieties, which have been distinguished and described by Dr. Christison.

396. *a.* The *acute form* of poisoning with this substance is differently characterized according as the arsenic affects more especially the alimentary canal, or the nervous system, and vital powers.—(*a*) When the *digestive canal* is more particularly attacked, signs of violent irritation are manifested along its whole course, with faintness, sickness, burning pain, and tenderness in the region of the stomach. When the poison has been taken in a state of solution, these symptoms are felt very soon after its ingestion—generally from ten to fifteen minutes; but, in other circumstances, it usually does not begin to act until half an hour after it is swallowed; and its operation is seldom delayed beyond an hour. Several cases are, however, recorded in which the action of the poison was not manifested for several hours—for three, four, five, or even seven hours. Dr. Christison thinks that it is delayed for a longer or shorter time by sleep. The sickness and pain are soon followed by retchings and vomiting, especially when drink is taken. There are also heat, dryness, and tightness in the throat and pharynx, creating an incessant desire for drink, attending and occasionally preceding the vomitings. Sometimes this affection of the throat is very slight. When it is severe, it is often attended by fits of suffocation and convulsive vomiting, and by hoarseness and difficulty of talking. The matters vomited after alimentary matters have been thrown off are yellowish or greenish, and in the more protracted cases they are streaked or mixed with blood. Soon after the appearance of the gastric symptoms, diarrhœa generally supervenes; but in some instances, instead of diarrhœa, the patient is harassed by ineffectual calls, or tenesmus. About this time the pain at the pit of the stomach is excruciating, and is likened to a fire within him. It often extends over the abdomen, which becomes tense, tender, and sometimes swollen; but occasionally drawn inward at the navel. If diarrhœa be considerable, or has continued for a short time, pain, heat, and excoriation of

the anus are complained of. In some instances, the burning pain and irritation with vascular injection appears to extend from the mouth to the anus; and there are frequently, also, observed signs of irritation of the air-passages and lungs, with shortness of breath, tightness across the lower part of the chest, and occasionally darting pains. Sometimes symptoms of pneumonia are more fully developed. The urinary organs are often affected, the patient being distressed by frequent, painful, and difficult micturition, by pain in the bladder, or swelling of the penis. Females frequently experience burning pain, swelling, or excoriation of the labia pudendæ. Occasionally the irritation is so great as to cause suppression of urine; but the disorder of the urinary organs rarely occurs unless the lower bowels are also severely irritated, and the case has been protracted for two or three days. Soon after the appearance of the first symptoms, the *pulse* becomes feeble, small, and rapid, and subsequently irregular, and hardly perceptible. The surface of the body and extremities are cold, and often covered with clammy cold sweats. The feet and hands are often livid. The features are collapsed, and expressive of extreme suffering and anxiety. The conjunctiva is often very much injected; and the eyes are red and sparkling. The tongue and mouth are parched; and aphthous appearances are sometimes observed in the throat. Convulsive motions, especially of a slight form, and consisting of tremours or twitchings, often commence in the trunk and become more general. When the diarrhœa is severe, or has continued for a short time, cramps in the legs and arms are severe and frequent. Delirium sometimes appears towards the close, and is occasionally attended by stupor. Death takes place calmly, but is sometimes preceded by convulsions. In some instances, a remission of the symptoms has been observed, particularly when life has been prolonged till the close of the second or third day. In cases such as now described, constituting the most frequent variety of the acute form, death occurs about twenty-four hours after the ingestion of the poison, and generally before the close of the third day; but, in rare instances, life may be prolonged until the fifth or sixth day.

397. (*b*) In the *second variety* of acute poisoning by arsenic, the signs of irritation and inflammation of the digestive canal are either slight or altogether absent; death ensuing in five, six, or seven hours, or at a period too early for the full development of inflammatory action, owing to the impression of the poison on the organic nervous system, and on the general vitality of the frame. When Sir B. Brodie injected a solution of the oxide into the stomach of a dog, the pulse was rendered slow and intermitting, and the animal became palsied in the hinder legs, lethargic, and died in convulsions. In some cases of this variety, one or two attacks of vomiting occur at the usual interval after taking the poison, but it seldom continues; extreme faintness, amounting almost to syncope, being the most uniform symptom. Pain is usually felt at the epigastrium, but it is sometimes very slight, and unattended by the other signs of inflammation. Occasionally there are oppression, stupor from depression, or slight convulsions; but the faintness and general sinking of the vital powers are the prominent phenomena, death commonly taking place in a few hours. Even in the more protracted cases, and where life continues till the second day, extreme vital depression is the most striking feature. Dr. Christison remarks that this acute variety has been observed, 1st, when the dose of the poison was very large; 2d, when it was in small masses; and, 3d, when it was in a state of solution. The first and last of these circumstances account for the rapidity and character of the symptoms, as furnishing the conditions favourable to a general or extended impression of the substance on the villous coat of the stomach, and a rapid absorption of it into the circulation; but the second circumstance just named admits not of so ready an explanation. Cases of this variety of poisoning by arsenic are not frequent; but Dr. Christison has referred to twelve instances in illustration of it; and which sufficiently show that the most rapid cases of poisoning by arsenic are not always attended by either violent or well-marked symptoms. It should, however, be recollected that the present variety passes insensibly into the former; that many cases will present phenomena approaching more or less either of the varieties now described, or intermediate between them.

398. All the above symptoms are not present in every case of the acute form, for pain may be entirely absent, although the quantity of the poison has been very great; the greatness of the quantity, as just stated, having been supposed to have been the cause of its absence. But Mr. Taylor states, that a case occurred in Guy's Hospital, where only forty grains had been taken, and the patient died without complaining of pain. The symptoms of intestinal irritation are seldom wanting, or there is vomiting if there be no purging. But Mr. Taylor refers to a case in which there was neither vomiting nor purging. Thirst, although a most common symptom, may also be absent.

399. *b.* The *chronic form* of poisoning by arsenic may also present *two varieties* or states.—(*a*) In *one* the symptoms may at first be acute and inflammatory; but these may subside, with or without treatment, and signs of nervous irritation and vital depression become most prominent; or the inflammatory and the nervous symptoms may appear together, and proceed *pari passu*. The nervous affection varies in different persons. It chiefly consists of partial or incomplete palsy in some cases, or of more or less complete epilepsy in others, or of partial or irregular convulsion; or they may even resemble those of hysteria, of tetanus, or of delirium, passing into stupor. Five individuals partook of a dish poisoned with arsenic, and were seized with the usual symptoms of inflammatory irritation of the alimentary canal. One of these had an epileptic fit on the first day, which returned on the second, with frequent twitches of the muscles of the trunk, numbness in one side, and heat and tingling of the feet and hands. Another had tremours of the right arm and leg, followed by epileptic fits in the night, which returned the next fifteen days at the same hour in the evening, and afterward recurred at intervals for several months.

400. Of the *secondary* effects of this variety of arsenical poisoning, *palsy* and spasm, or *con-*

tractions of the extremities, are the most frequent. The palsy is generally partial, and often commences at the fingers or toes, and proceeds gradually upward. Dr. Murray (*Edin. Med. and Surg. Journ.*, vol. xviii., p. 167) has given an instructive account of this effect of arsenic. Four persons were affected about an hour after breakfast with the primary symptoms of poisoning by arsenic. But, in addition to these, the muscular debility was extreme; and in two amounted to true partial palsy. One of them lost altogether the power of the left arm. The other had great general debility, and long-continued numbness and pains of the leg. In a case of an over-dose of the arseniate of potassa, the paralytic affection consisted in the loss of sensation and of motion of the hands, and the loss of motion in the feet, with contraction of the knee-joints.

401. (*b*) In some instances, especially *when the dose of the poison has been small and frequently repeated*, instead of the acute or inflammatory symptoms at the commencement, indications of *slow* or *chronic poisoning* approach insidiously, and may be mistaken for chronic disease of the digestive organs or of the nervous system. Hahnemann has briefly defined *slow poisoning* by arsenic as "a gradual sinking of the powers of life, without any violent symptom—a nameless feeling of illness, failure of strength, an aversion to food and drink, and all the other enjoyments of life." This is, however, not a correct view of such cases, although it may represent a few of the most slow or chronic states produced by this poison; as with the gradual sinking of vital and of muscular power, there are generally more or less of the symptoms about to be enumerated also present: Protracted indigestion with flatulence, pain in the stomach or bowels, sometimes in the course of the colon; slight diarrhœa, or tenesmus, or both; furred tongue, with dryness, constriction of the throat, and thirst; severe attacks of flatulence, sometimes with hiccough when substances are taken into the stomach; occasionally salivation or exfoliation of the epithelium of the lips, cheeks, and throat; inflammation of the conjunctiva, with suffusion of the eyes, intolerance of light, and frequently with a dark circle surrounding the eyes; irritation of the skin, often with an eruption—the *Eczema arsenicale*—and exfoliation of the cuticle, and falling out of the hair; extreme muscular weakness, tremours, paralysis, spasms, or contractions of the limbs; sometimes convulsions, anxiety, faintness, or syncope; shortness of breathing, dry cough; palpitations on slight exertion, or upon being startled, remarkable weakness, smallness, and irregularity of the pulse; emaciation, swelling or œdema of the extremities; nervous headache, mental depression, sometimes low delirium, stupor, or even death, have supervened upon excessive or too long continued doses of arsenical preparations. I once suffered severely from dyspepsia and excessive flatulence, caused by an accidental overdose of Fowler's solution; and I have met with several cases where the above symptoms—some in one case, others in another, &c.—have followed the use of these preparations. There is also some reason to believe that endocarditis and lesions of the valves of the heart have been excited by the too liberal employment of the arsenical solution. I have at present a patient with disease of the cardiac valves, who has taken the solution in very large doses, and during several protracted courses, for lepra.

402. *B. The application of arsenic to sores, ulcers, or eruptions; or to wounds, or to blistered or other surfaces deprived of its cuticle*, often has produced fatal poisoning. When arsenic is thus applied, both local inflammation is excited or increased, and constitutional effects are produced by its absorption. Wepfer states that a girl, affected with psoriasis of the scalp, had it rubbed with a liniment of butter and arsenic; and was soon seized with acute pain and swelling of the whole head, fainting fits, restlessness, fever, delirium, &c. She died in six days. Similar cases are recorded by Amatus Lusitanus, Zitmann, Belloc, Roux, Blackadder, and others; the arsenic having been applied to sores or ulcers. Harles remarks, respecting the propriety of the outward application of this substance, that it may be applied with safety to abraded surfaces, to common ulcers, or to malignant sores, even when highly irritable, provided the part be not recently wounded, so as to pour out blood. This distinction is not, however, to be confided in under every circumstance; for the poison may be absorbed without being imbibed by the venous capillaries of the part.

403. When arsenic is thus applied, inflammation of the part, extending more or less, is generally produced. In some instances the local irritation is but slight, or altogether absent; but it is in others very severe. The lesions consequent upon the absorption of the poison, when thus employed, are irritation of the stomach and bowels, especially of the rectum; various affections of the nervous system, as spasms, convulsions, palsy, &c.; faintness, and vital depression. In several instances palsy has appeared in parts adjoining that to which the poison was applied. An arsenical preparation was long employed to destroy a tumour on the right side of the neck, and was followed by complete palsy of the muscles of the neck and arm of that side.*

* [We have known three cases of death, caused by the absorption of arsenic, from cancer plasters applied by quacks for the cure of this disease. The patients died from peritonitis and enteritis, the poison being determined to the serous surfaces, there producing the ordinary symptoms of inflammation of these organs. A case is reported by Dr. Hosack, in the *American Medical and Philosophical Register*, vol. iii., p. 389, where palsy of the right arm and neck was occasioned by the external application of arsenic, for the purpose of removing an encysted tumour on the side of the neck. Dr. Moore Hoit, of New York, has reported a fatal case from the absorption of arsenic applied to a tumour at the angle of the jaw. (*New York Med. and Phys. Journal*, vol. iii., p. 375. In France, the *pâte arsenicale* is used, consisting of *cinnabar*, 70 parts; *Sanguis draconis*, 22; *arsenious acid*, 8; made into a paste at the time of applying it. In England, Plunkett's *Ointment* is used, consisting of *arsenious acid*, *sulphur*, and the powdered leaves of the *Ranunculus inflammata* and *Cotula fetida*; also, Davidson's *Remedy for Cancer*, *arsenious acid* and *powdered hemlock*. In the United States, we have, among others, Davidson's *Cancer Plaster*, the active ingredient of which is *arsenic;* the *poke-root* is also used, in form of an extract, but arsenic is mixed with it in all cases by the cancer quacks.

A medical gentleman, during the past year, being greatly annoyed by a carious tooth, was induced, by the urgent solicitation of several of his friends, to apply to the affected part a paste, in which it was ascertained the white oxide of arsenic was one of the ingredients. Within a period of two hours, local inflammation took place so rapidly as to involve the whole of the jaw of one side. Before many hours had elapsed, though active antiphlogistic means were promptly adopted, the inflammation soon involved the fauces, throat,

404. *C. The Poison may be administered in Enemata.*—Fodéré adduces the following case: A lady was under treatment for some slight disorder, but died unexpectedly after symptoms of poisoning. It was afterward discovered that her servant, after unsuccessful attempts to poison her by dissolving arsenic in her soup, had succeeded by administering it in injections. In this way, doubtless, all the effects of arsenic may be produced, and the poison be the less likely to be detected after death, this mode of poisoning requiring all the vigilance which the physician can exert.

405. *D. This Poison may be introduced into the Vagina.*—Among other instances of this mode of poisoning adduced by Ansiaulx and Christison, the following is recorded by Dr. Mangor: A farmer near Copenhagen lost his wife under suspicious circumstances, and six weeks afterward married his maid-servant. In a few years he attempted, aided by another servant, to poison his second wife. Having failed, he introduced a mixture of arsenic and flour into the vagina after coition in the morning. The symptoms appeared about midday, and death took place next morning. The murderer married, soon after, his guilty paramour, and after a few years got rid of her in a similar manner. About three in the afternoon she was seized with shivering, and with heat and pain in the vagina; the poison having been introduced in the morning. The remembrance of her former crime excited her suspicions, and she wrung from her husband a confession. On the local symptoms, acute pain in the stomach, incessant vomiting, and delirium supervened: death took place after twenty-one hours. On *dissection*, grains of arsenic were found in the vagina, although frequent lotions had been used in the treatment. The labia were swollen and red, the vagina flaccid, the os uteri gangrenous; the duodenum was inflamed, the stomach natural.

406. *E. Poisoning by Arsenic may take place through the Respiratory Organs.*—This usually occurs in consequence of the *accidental inhalation of arsenical vapours*. Otto Tachenius, a chemist of the sixteenth century, quoted by Dr. Christison, states, that he once incautiously happened to breathe the fumes of arsenic, and was surprised to find his palate impressed with a sweet, mild, grateful taste, such as he never experienced before. But in half an hour he was attacked by pain and constriction of the stomach; then with difficult breathing, general convulsions, an unspeakable sense of heat, bloody and painful micturition, and, finally, with such an acute colic as contracted his whole body for half an hour. He recovered from these alarming symptoms by taking oleaginous drinks; but during all the succeeding winter he had low hectic fever. There can be no doubt of arsenical vapour or fumes being rapidly poisonous, when inhaled in a concentrated state, or even when very diluted, if longer breathed; and then they may produce slow or chronic poisoning. The vapour may even be employed in this way with criminal intentions. Dr. Christison has quoted several writers and cases illustrative of this mode of poisoning. The following is a most instructive instance of the kind: An apothecary inhaled the fumes while subliming arsenic, and was soon after seized with frequent faintness, constriction at the præcordia, difficult breathing, constant thirst, parched tongue and throat, great restlessness, watchings, and pains in the feet. He had afterward profuse daily perspirations and palsy of the legs, and several months elapsed before he quite recovered. (*See* B. Timæus, *Cas. Med.*, L. vii., c. 11; and Christison, *Op. cit.*, p. 302, for similar cases.) Paracelsus, being one day enraged with an acquaintance, held him over an alembic in which arsenic was subliming; but the object of his temper nearly lost his life.

407. *F. Applied to the sound skin*, arsenic has either no effect, or merely a slow and slight effect, unless under certain circumstances. If the poison be simply placed in contact with the skin it seldom acts; but if it be rubbed upon the skin, especially when mixed with fatty matters, it acts chiefly locally, producing a pustular eruption or eschars; but according to Renault it produces no constitutional disorder. This statement, however, should not be depended upon; for there are several facts recorded that prove arsenic sometimes to have been productive of very serious local and constitutional effects when applied to the human skin, either in the state of fine powder, or in the form of ointment, liniment, or paste. In these cases, several of which are adduced by Dr. Christison, the symptoms were faintings, giddiness, pain in the stomach, vomitings, tenesmus, ardor urinæ, tremblings of the limbs, low delirium, hectic fever, debility, prolonged recovery, and falling out of the hair.

408. *G. Diagnosis.*—Poisoning by arsenic may be mistaken for the severer states of *cholera*, or even for a case of *pestilential cholera*. The propriety of deciding the question from the symptoms alone, as to whether or no poi-

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larynx, and trachea, and he died in extreme distress, with what was recorded as laryngitis, before twenty-four hours had expired from the commencement of the fatal application.

"This powerful agent" (arsenic), says Dr. Francis, "whether given internally or applied externally, is capable of destroying life with equal certainty. A valuable member of our community, the late Mr. O., fell a victim to the empirical practice of arsenic, in the form of unguent, applied to a small tumour situated between his shoulders. In this case," adds Dr. F., "I had an opportunity of testing the accuracy of Mr. Brodie's idea of the action of the arsenious acid on the human constitution. Mr. Brodie considers this mineral poison in its operation to produce its effects primarily on the nervous system, and that death is the result of the suspension of the functions of the heart and brain. In Mr. O.'s case this theory was verified. There was paralysis of almost every limb of the body, and every joint seemed to be greatly enlarged and tumid; the intellectual functions were nearly destroyed; he died suddenly and unexpectedly, in a manner characteristic of death by arsenical poison."—*Facts on Medical Jurisprudence, New York Med. and Phys. Journal*, vol. ii.

We have facts confirmatory of this pathology in the issue of cases in which arsenic is preposterously employed for the cure of tinea capitis.

Gilman Davis, of Portland, Maine, reports a case (*Boston Med. and Surg. Journal*, vol. xxviii., p. 214) of poisoning by arsenic in a woman, who took half an ounce of arsenic, attended with severe vomiting, but no pain or thirst. She took the carb. ferri in large doses, but died the next day.

Dr. Storer, of Boston, reports several cases of poisoning, in the *Boston Medical and Surgical Journal*, vol. xxiii., p. 345–8. In one case, that of Mr. Kinney, who was supposed to have been poisoned, there was found extensive ecchymosis of the mucous membrane of the stomach, which Dr. S. considers characteristic of poisoning by this substance, and which, with the bloody tinge of the fluid in the cavity of the peritoneum and pericardium, would serve to distinguish the case from one of cholera. In one of the other cases there was no vomiting, although emetics were given, nor any pain of any kind complained of, nor swelling of abdomen. Death ensued five hours after the poison had been swallowed, perfectly rational, and without a struggle.]

poisoning has been produced by arsenic, belongs more especially to the writer on Medical Jurisprudence. This question has been ably discussed by Dr. Christison and the other writers so often referred to. But the diagnosis between poisoning by this substance and natural disease falls more especially within my province. It should be admitted that the diagnosis is often difficult; but due attention to the history of the case, especially in respect of the accession of the attack; the prickings, burning sensations, or heat, redness and constriction in the throat, and in the course of the œsophagus, especially early in the attack; the redness of the eyes; the swelling, heat, pain, and excoriation of the anus; the tenesmus, and the burning or colicky character of the abdominal pain; the ardor urinæ, dysuria, and heat of the urinary passages; the increased suffering on speaking and swallowing; the consecutive eruption of pimples, or excoriations of the lips, tongue, and throat; the nature of the nervous symptoms, particularly the epileptic form of convulsions, the incomplete or partial palsy, the nervous sinking, anxiety, and muscular tremours, and the low delirium, are diagnostic of poisoning, especially by this substance, and are rarely present, even individually, in cholera, and perhaps never in such states of association as are observed after the administration of arsenic. But strict attention to the phenomena and recollection of the symptoms, as described above, will show the nature of the case with tolerable certainty; although much more precise information, as respects both the moral circumstances and the chemical investigation, will be required for the administration of justice.

409. *H. The Organic Lesions produced by the Preparations of Arsenic.*—These have been described most ably by Dr. Christison, and illustrated by reference to numerous cases, to which I must refer the reader. The changes produced by arsenic are numerous, and varied in most instances, according to the quantity administered, the state of the stomach at the time, and the period the patient lived after its ingestion. Similar changes are usually observed after poisoning by the external application of the substance to those produced by its internal administration. The most remarkable alterations are generally found when the quantity swallowed has not been very large, and when the individual has lived sufficiently long to admit of the development of inflammatory action and its more immediate consequences. When death has taken place very rapidly—in a shorter period than eight, or ten, or even twelve hours, little or no change is often observed. In these cases it may be presumed that the impression of the poison on the organic nervous system, and the action consequent upon its absorption on the heart and nervous centres, cause death before vascular reaction could supervene.—*a.* Much more frequently, however, the internal surfaces of the stomach and duodenum, often also of the œsophagus and pharynx, on the one hand, and of the intestines, more especially the rectum and colon, on the other, evince signs of inflammatory irritation and certain of its more immediate results, especially capillary injection, sometimes with small ecchymosis, or slight extravasations of blood, or softening of the villous coat, or effusion of lymph, or ulcerations. Redness, with vascular injection, is seldom absent from the throat and gullet, when the patient has lived above a few hours. In the stomach the colour is often a dull or brownish red; or it is of a brighter hue, interspersed with dark striæ of altered blood. The ecchymoses and larger extravasation of blood are always of a dark hue. Ulceration rarely occurs, and chiefly in cases where death has not taken place until after the second or third day. Although inflammatory appearances may be absent in cases which have ended rapidly, yet they have been found in the stomach in several which have terminated in five, six, seven, or eight hours after the administration of the poison. Thickening, or tumefaction of the villous membrane, with more or less softening, a friable state of it, and even abrasions of minute portions, are occasionally observed. Gangrene and perforations of the stomach or intestines are never found. Changes, which have been mistaken for gangrene, have consisted chiefly of extravasations of dark blood. The ulcerations said to have been found in some instances when death has taken place a few hours after the ingestion of the poison, are very probably minute abrasions or excoriations of the villous surface. A sanguinolent fluid is sometimes found in the cavity of the stomach; and occasionally arsenic, variously altered in its appearance, is found closely adhering to the internal membrane. The colon is often much contracted and its inner surface inflamed, especially the sigmoid flexure and the cæcum. The rectum is generally much inflamed and excoriated, the latter change extending around the anus, particularly when life has continued one, two, or three days.

410. *b.* The *respiratory organs* sometimes are found congested, and the bronchial membrane more or less reddened. Occasionally the pleura is injected, and slight effusions of serum exist in the pleural cavities. The *heart* is generally flabby, and sometimes the inner surface, particularly the columnæ carneæ and valves, is more or less reddened. The *blood* is often fluid, and generally dark-coloured. Slight effusions of serum and congestion are occasionally found within the *cranium*. Inflammatory changes are frequently seen in the *urinary passages*, and often extending to the female sexual organs.

411. *c.* The *antiseptic influence* of arsenic, more especially upon those parts where this substance exerts its injurious action, or where it is brought in contact, has recently attracted attention and been fully established. It thus very frequently not only preserves these parts, more especially the alimentary canal, from putrefaction, but also the alterations which it had produced in them. It may be presumed that the amount of antiseptic effect will depend very much upon the quantity of the poison, and upon the retention of it in the body at the time of death. If much of it remain in the stomach and bowels, or become absorbed and continue either in the blood or in the several tissues and organs, an antiseptic and mummifying effect may be expected; but if the poison be discharged by vomiting and purging, and eliminated from the body before death takes place, then the putrefactive process will proceed as usual, or even with greater celerity. This effect of arsenic in arresting the progress of putrefaction seems to be the result of a chemical action exerted by

this substance upon the fluids and soft solids of the body.

412. *I. The quantity of arsenic likely to destroy life* depends upon a variety of circumstances. But *four grains*, or even *three*, may kill a child, if it be taken in solution or when the stomach is empty. Dr. Christison adduces the case of a child who died in six hours after taking four grains and a half in a state of solution; and a woman, 70 years of age, was killed by four grains. Mr. Taylor states that a young lady died after eating a portion of cake which could not have contained more than *four* grains, and probably less than three grains. He states that three of a party at dinner who had partaken of the port wine on the table were seized with symptoms of arsenical poisoning. The wine was found to contain about one to two grains of the poison in each fluid ounce. A lady took a quantity containing less than two grains of arsenic. In about half an hour she experienced faintness, violent vomiting, but no pain. She recovered after a few hours. A gentleman took as much as contained little more than two grains. His symptoms were similar, but more severe. If he had taken another glass of the wine, he might have been killed. Although the wine was saturated with arsenic, yet no peculiar taste was perceived. The escape of these persons was probably owing to the circumstances of the wine having been taken on a full stomach, and of its having been soon followed by violent vomiting. It is probable that from one to two grains would prove fatal to a child or to a debilitated person, and three grains to an adult. On the other hand, cases of recovery from the ingestion of large quantities are not infrequent. A person recovered after taking half an ounce, the poison having been carried off by vomiting and purging; but instances of recovery from so large a quantity are very rare, and are owing to the arsenic having been taken on a full stomach, and to its speedy evacuation.

413. *K. The period at which death takes place from arsenic* varies with the circumstances so often alluded to. Dr. Borland informed Mr. Taylor of a case in which two ounces of arsenic were taken, and death took place in less than *two hours* from syncope. There was neither pain, vomiting, nor diarrhœa. Such rapidly fatal cases are very rare. But the time at which death takes place is not strictly dependent upon the quantity of the poison taken. There are many cases reported in which death has occurred in from three to seven hours, but much more frequently it does not supervene until a period varying from twelve or eighteen hours to three days, in the acute forms of poisoning by this substance. In thirteen cases recorded by Dr. Beck, the smallest quantity taken having been one drachm, and the largest two drachms, the shortest period for death was four hours, the longest two days. In one instance, two ounces of the poison destroyed life in three hours and a half; but in another case four or five grains killed a person in four hours; so little does the rapidity of the effect depend upon the dose or quantity. When the poison has been administered in small and repeated doses, and in cases of *slow* or *chronic* poisoning, and in some instances of the external application of it, and when a partial recovery from the first effects has occurred, a fatal issue may not take place until many days or weeks after its administration.

414. *L. The modus operandi of arsenic* has not always been rightly estimated. This substance has been generally considered as a tonic; but, judging from my experience of its action in my own person, and in the treatment of many diseases, I cannot believe that it possesses any tonic properties, but, on the contrary, that it exerts an *irritating* and *depressing influence*; its chief *medicinal effects* being *anti-periodic* and *alterative*, effects which result from the employment of it in very small and frequently repeated doses; an irritating and depressing, or paralyzing action, following the administration of larger doses. Its local operation is chiefly as an irritant, capillary injection, inflammation, and its immediate consequences usually occurring. But the primary impression produced by large quantities of this poison is probably sedative as respects the nervous system, both locally and generally, inasmuch as death, preceded by signs of vital depression, often takes place before inflammatory appearances are developed. That *arsenic is absorbed* into the circulation, and affects this fluid, the heart, and the nervous centres, are facts which the detection of it in the liver, spleen, kidneys, [serosity of blisters], lungs, and urine, fully proves, and which the changes in these organs farther serve to show. Even when it is applied to an abraded surface, or to parts which admit of its absorption, it has been found to affect more especially the inner surface of the stomach, duodenum, and large bowels, and it has been detected in these situations by chemical research. It appears to exert a specific influence upon the alimentary canal, irritating and inflaming it, and, at the same time, depressing the organic nervous energy. It exerts, also, a marked action on the emunctories by which it is carried out of the circulation, especially the urinary organs, the villous surface and glandular apparatus of the large bowels, the skin, and lungs; exciting, irritating, or inflaming these, according to the quantity existing in the circulating fluids.

415. *M. Treatment.*—As the poisonous operation of the preparations of arsenic is chiefly owing to the absorption of them, it is obvious that, before they can be absorbed, they must be dissolved—either dissolved when administered, or subsequently by the juices of the stomach. Therefore, no substance ought to be recommended as an *antidote* unless it possesses the property of rendering the arsenic insoluble, or of preventing its solubility; and no known compound possesses this power to any considerable extent. The *hydrated sesqui-oxide of iron* possesses this property to a certain extent. Mr. Taylor performed many experiments on this antidote, and obtained the following results: 1st. When arsenious acid is *dissolved* in water, and agitated with twelve or fifteen times its weight of the hydrated oxide, the poison is precipitated with it in a very insoluble form. 2d. When the poison is mixed and agitated in a state of *powder* with the oxide, there is little or no effect, the poison being only mechanically diffused through the oxide. 3d. When the poison in powder is mixed with oxide of iron, rendered alkaline by ammonia, so much appears to

combine with the iron as the quantity of alkali present will render soluble in cold water. The rest is diffused in granules through the oxide. Most of the experiments, he adds, in favour of this antidote have been performed in solutions of arsenic; and therefore the results are irrelevant, since arsenic is most frequently taken in powder, and often in very coarse powder. Recently the *acetate of the sesquioxide of iron* has been recommended as an antidote by M. Duflos; but Mr. Taylor found that, in respect of arsenic in *powder*, it is as inefficacious as the hydrated oxide, even when an alkali is added, to produce effectual precipitation; and that, with regard to the solution, the poison is more readily precipitated by the hydrated oxide than by the acetate of iron. Other antidotes have been mentioned, more especially large doses of *magnesia* and *charcoal*; but they deserve little credit, and are no farther serviceable than by involving the poison more or less, and thereby preventing its action upon, or its absorption by, the surface of the stomach: an intention which may be accomplished more completely by albumen, milk, and various other substances. The substances formerly lauded as antidotes have been shown, by the researches of Renault, Orfila, and others, to be quite inefficacious; whatever of success may have followed their exhibition having been owing to the several circumstances shown above (§ 51, *et seq.*) to modify, counteract, or prevent the operation of poisons.

416. So little advantage, therefore, being likely to be derived from antidotes, our chief hopes should be placed on the immediate evacuation of the poison from the stomach, and upon the removal of the injurious effects which may have been produced. If *vomiting* has not taken place, or is insufficient, it should be promoted by an emetic of sulphate of zinc, or sulphate of copper, or by mustard taken at intervals in a wineglass of water, or by tickling the throat with a feather; or the contents of the stomach may be removed by the stomach-pump, avoiding as much as possible the introduction of fluids when the poison has been taken in a state of powder or of imperfect solution. When vomiting takes place, it may be promoted by taking albumen, milk, thick mucilaginous fluids, linseed tea, &c.; and, although the patient should not be allowed to exhaust his strength in retching, without some one of these fluids being taken for the stomach to act upon, still it should not be taken in too large a quantity at one time, in order that the stomach may contract frequently on itself, and thus expel from its surface the mucous secretion which often envelops the poison, and protects the inner surface of the organ from its action. Mr. Taylor advises a saponaceous liquid, made of equal parts of oil and lime-water, to be given; and Dr. Paris a free exhibition of olive oil. When vomiting has commenced from the action of the poison, an emetic or the stomach-pump is then necessary, as this operation will proceed, when aided by the fluids just mentioned.

417. Having by these means discharged the poison from the stomach, there generally remain two formidable morbid conditions produced by it to be removed. These are inflammatory irritation and action of the alimentary canal, and nervous or vital depression, with various concomitant phenomena. This association is of the most perplexing kind, inasmuch as the means calculated to relieve the one aggravates the other. Nevertheless, if there is sufficient reason to infer that the poison is altogether evacuated, and more especially if the first impression or shock produced by the poison has passed off, the pain and vomiting having developed more or less reaction, blood-letting, general or local, or both, will be practiced with advantage; but if too early resorted to, the absorption of the poison and the vital shock may be both increased by it. Terebinthinated epithems, sinapisms, or blisters over the epigastric region, or over the greater part of the abdomen, and a free exhibition of opium by the mouth, and in starch or mucilaginous enemata, are generally most beneficial; but before opium be given, the entire evacuation of the poison should be ensured. Subsequently, and when the irritation of the bowels assumes a dysenteric character, or when tenesmus or dysuria is urgent, the opium may be conjoined with ipecacuanha, camphor, nitrate of potassa, tragacanth, &c.; and these may be administered also in enemata. The medicated warm-bath; fomentations to the perinæum and anus, preceded by the application of leeches to those parts, and a farinaceous or mucilaginous diet, are important parts of the treatment.

418. The *nervous symptoms* often accompanying the vital depression produced by the poison are most successfully treated by opium taken with small doses of camphor; by the application of terebinthinated embrocations; and by mild tonics and restoratives in small doses, and in demulcent vehicles. If palsy continue after the removal of disorder of the digestive organs, exercise in the open air, the preparations of nux vomica, or strychnia cautiously prescribed, and external irritants are the chief means of cure. If the bowels become confined, either during the more chronic cases, or during recovery or convalescence, olive oil, taken in frequently repeated doses, and administered in enemata, is the most appropriate aperient. During convalescence, and for a long period afterward, dyspepsia, flatulence, and various states of disorder of the digestive organs often continue for a long time, and are best relieved by change of air, by travelling, and by strict attention to diet; by the adoption of a bland, farinaceous diet, avoiding spirituous liquors, and the substances pointed out as injurious in the article on Indigestion.

419. iii. Colchicum Autumnale — *Meadow Saffron.*—All the parts of this plant are poisonous at such periods of the year as occasion their development or perfection, but they vary slightly in their effects. The several preparations of the plant have lately been much employed in medicine, on account of their influence in paralyzing or diminishing morbid sensibility, in removing pain, and in increasing the functions of excreting organs, especially of the digestive canal, the liver, and kidneys; its effects on these, however, being by no means certain. In large doses, it acts as an irritant of the alimentary canal; and as a sedative, often remarkably depressing vascular action and vital power. Even from small or medicinal doses, these injurious effects are manifested in some instances, and not in a few of these the vital depression is ex-

treme, and consequent upon one third or one fourth of the usually prescribed medicinal dose. I have seen on several occasions poisonous effects produced by too great temerity in the use of this medicine; and these effects were not manifested so injuriously on the digestive canal as on the nervous system and vital influence; extreme sinkings, failings of the pulse, and syncope, following its ingestion. In two instances —in one a powerful man—a single dose of only ten minims of the tincture, which I prescribed for gout, produced alarming symptoms; and a drachm, taken by a medical man contrary to my advice, produced effects from which he recovered with difficulty. In some constitutions, owing to idiosyncrasy, it acts with remarkable severity, particularly as respects the vital depression produced by it. Geiger and Hesse discovered a principle in this plant, or alkaloid, which has been called *colchicina*, *colchicia*, or *colchicine*, and which neutralizes acids, and forms with them crystallizable salts.

420. *A.* The *symptoms* arising from poisonous doses of colchicum have been described by Messrs. Fereday, Chevallier, Dillon, Haden, and Christison. The *cormi*, the *seeds*, the *flowers*, and the *leaves* of the plant produce nearly similar symptoms when taken in large quantities. An hour, or an hour and a half, after the ingestion of the poison, acute pain, followed by retchings, vomiting, and tenesmus or purging, or both, is experienced. The pulse soon becomes feeble, the countenance anxious, and afterward the matters vomited are dark-coloured, and the purging profuse and watery. The pulse is excessively slow or feeble, the respiration hardly perceptible or feeble, the muscular weakness extreme, and the urine suppressed, the watery portions of the blood being discharged by the bowels and stomach. The patient sinks after a period, varying with the dose and the constitutional powers, from a few hours to three or four days; but there are neither convulsions, nor insensibility, nor delirium, unless in a few instances. Mr. Taylor states that a burning pain is felt in the throat and œsophagus; but this is not mentioned in the details of some cases, and probably it depends much upon the state in which the poison is taken. Mr. Mann communicated to him a case in which three drachms and a half of the wine of colchicum were taken in divided doses, and caused death on the fourth day. There was no inflammation of the mucous membrane found on *dissection*, but simply extravasation of blood into the mucous follicles. Mr. Taylor states, that a man took a decoction made with a table-spoonful of the seeds and a pint and a half of water. He was seized with vomiting and purging, which were incessant until death, which took place in about thirty-six hours. The only appearance of note was, that the stomach had a violet or purple hue. A gentleman swallowed, by mistake, an ounce and a half of the wine of colchicum: he was immediately seized with severe pain and the other symptoms, and died in seven hours. In another instance, where an ounce was taken, death occurred in thirty-nine hours. Most of the cases recorded of poisoning by this substance have been detailed imperfectly and loosely. In Mr. Fereday's case, which has been given more fully than the others, there was no cerebral disturbance.

421. *B.* The chief appearances observed on *dissection*, were a patch of redness in the internal surface of the stomach, near the cardiac orifice, and a slight effusion of blood between the muscular and peritoneal coat of a portion of the jejunum. The omentum was turned up between the stomach and convex surface of the liver behind, and the diaphragm in front. The pleuræ were somewhat reddened, and the lungs much congested with black blood. The heart was flabby, and its structure easily broken down. The surfaces of the lungs, diaphragm, and heart were covered with ecchymosed spots. The bladder was empty. The face, neck, front of the thorax, insides of the thighs, and the integuments of the scrotum and penis, were covered with patches of purple efflorescence. (*Lond. Med. Gaz.*, vol. x., p. 160.) In the bodies of the children mentioned by Bernt there was considerable redness of the stomach and small intestines. In Geiger's case, inflammatory appearances were seen in the stomach and small intestines. In a case related by M. Chevallier, and in another adduced in the *Edinburgh Medical Journal*, no alterations were found. (Christison, *op. cit.*, p. 792.)

422. *C. Treatment.*—Retchings often continue for some time, and are ineffectual; therefore full vomiting should not be expected without the aid of an emetic, which may consist of sulphate of zinc or mustard mixed in water. The stomach-pump may be employed if the patient be seen soon after the ingestion of the poison. After the evacuation of it from the stomach, it remains to counteract the injurious impression produced by it on the organic nervous system, and upon the heart and nervous centres by its absorption into the circulation; and the only means we can employ with these intentions with any hopes of success, are opium, ammonia, camphor, capsicum, and creasote, variously combined, according to circumstances. I have had very frequent recourse to the preparations of colchicum in practice, but have seldom given them in full doses without conjoining them with one or more of these substances, which have always prevented any unpleasant symptoms from following their administration. Where idiosyncrasy, also, has stood in the way of their exhibition, I found these medicines prevent any sinking and distress, and to remove these effects when they have appeared. There can be no doubt, therefore, that these remedies are most appropriate in cases of poisoning by colchicum. They may be aided by sinapisms, or terebinthinate embrocations, or epithems over the abdomen, and by mucilaginous or oleaginous draughts and injections, which may be made the vehicles of the remedies just advised.

423. iv. Hellebore.—*Black Hellebore, Helleborus Niger—White Helleborc, Veratrum Album —Veratrum Sabadilla—Veratrine—Veratria.*—The operation of black hellebore and of veratrum is nearly similar; and the alkaloid of the latter—*veratria*—produces the same action as either of these, a much smaller quantity being required to produce the same amount of effect. —*A. Black hellebore*, in poisonous doses, causes a burning pain in the stomach and intestines, vomitings, purging, cramps in the lower extremities, cold sweats, faintness, paralysis, sometimes insensibility from exhaustion or vital depression, and extreme weakness of the

pulse. Death appears to result from the excessive vomitings and purging, and impaired irritability and action of the heart.

424. *B. White hellebore*—*Veratrum album*—acts as a local irritant, exciting at the same time the nerves of the part. In excessive doses, it irritates the digestive mucous surface, and depresses nervous and vital power. The *symptoms* are violent vomiting and purging, sometimes of blood; tenesmus, and griping pains in the bowels. These are preceded or attended by a burning sensation in the mouth, throat, and œsophagus; constriction of the throat, with a sense of strangulation; and are soon followed by a small or almost imperceptible pulse; by faintness, cold sweats, tremblings, giddiness, loss of voice, blindness, and dilated pupils, insensibility, syncope or convulsions terminating life. In some cases, noticed by Dr. Pereira as having occurred to Dr. Rayner, these symptoms were present, with the exception of purging.

425. *C. Veratria* is poisonous in very small doses. Mr. Taylor states that a physician prescribed for a lady one grain of veratria divided into fifty pills, and three were directed to be taken for a dose. Not long after the first dose had been swallowed she was found insensible, the surface cold, the pulse failing, and with other symptoms of approaching dissolution. She remained some hours in a doubtful state, but ultimately recovered. If the veratria was well mixed in the pills, the dose was here not large; but this admits of doubt.

426. *D.* The *treatment* of poisoning by these substances is similar to that recommended for other poisons belonging to this class. After the evacuation of the poison, the effects should be attempted to be removed by means of stimulants conjoined with opium. In a case treated by Dr. Pereira, the infusion of nutgalls seemed to give relief. Coffee has been recommended both as a drink and as a clyster. The external applications already advised in similar circumstances should not be withheld. Demulcents should be made the vehicles for stimulants, astringents, and opiates.

427. v. Food Poisons—*Poisonous Food—Poisonous Fish — Poisonous Meats — Poisonous Cheese.* — Various articles of food not infrequently occasion injurious effects, and even death in a few hours. The slighter effects have sometimes arisen from idiosyncrasy; but not so frequently as supposed by some writers. This cause may be admitted in respect of those instances which have sometimes occurred of a single person only having been affected, of several who have partaken of the same article or dish. Poisonous articles of food—fish, meats, &c.—have hitherto been classed as *acro-narcotics.* As they are more or less *irritant*, and as acrid and irritant convey ideas nearly related, the first part of the appellation somewhat approaches the truth; but that they produce narcotic or stupefying effects cannot be so readily conceded, inasmuch as this particular effect no farther appears than as it results in some instances from the sinking of vital and cerebral power, and the diminution of sensibility owing to this state. These poisons, in truth, act as irritants of the alimentary canal, and as sedatives or depressants, or paralyzers of organic nervous or vital energy. While they irritate the mucous surfaces, and glandular apparatus of that surface, they rapidly depress vital power; and the irritation they occasion passes not into inflammatory action, but into excessive secretion and exhalation; or, if inflammatory action be developed, it is of an asthenic and spreading form. That these poisons do not act locally only, may be inferred from the ultimate effects being much more serious in most instances than the amount of local lesion can explain; from their contaminating nature, from the ready imbibition of them by mucous surfaces, and from their speedy absorption from these surfaces. The various articles which are sometimes productive of poisonous effects occasion modified or even different symptoms; but they are remedied by very nearly the same means.

428. *A.* Poisonous Fish.—Several species of fish, both in this climate and between the tropics, are always poisonous; and others are injurious only occasionally or rarely. Some accounts of the poisonous fishes of the tropics have been given by Drs. Thomas, Chisholm, and Fergusson; and various memoirs and notices of the poisonous fish found in Europe have been published by Dr. Burrows, Dr. Combe, Dr. Edwards, Professor Orfila, and Professor Christison. I had occasion many years ago, within the tropics, to treat a case of poisoning by fish, which nearly proved fatal; and I have seen two or three instances of poisoning by mussels in this country; but there was no danger in these cases, although the symptoms were severe. The fish which are the most frequently injurious in this country are all the kinds of edible shell-fish, especially mussels, cockles, periwinkles, lobsters, crabs, and craw-fish. And either of these, when kept too long after having been boiled, or when only parboiled and reboiled after various intervals, as sometimes practiced by the lower dealers, will produce more or less disorder. Salmon and eels are also sometimes poisonous, but the former is injurious chiefly when out of season, or when insufficiently preserved.

429. *a.* The *symptoms* produced by poisonous fish differ much in different persons; and certain of the effects observed are more or less owing to idiosyncrasy; but the most violent and fatal operation is not so frequently, if at all, owing to this cause—.(*a*) Thirty persons were poisoned by mussels in Leith in 1827, and of these two died. The symptoms were carefully observed and described by Dr. Combe. No one complained of anything peculiar in the smell or taste of the mussels, and none suffered immediately after eating them. An hour or two or more elapsed, and then the bad effects consisted rather in uneasy feelings and debility, than in distress referable to the stomach. After eating two or three, and various numbers above this, the lowest number, slight tension at the stomach, with heat and constriction of the mouth and throat, was complained of. These were succeeded by a difficulty of swallowing and speaking freely, by prickly feelings in the hands; by numbness about the mouth, gradually extending to the arms, with great debility of the limbs. Two or three had cardialgia, nausea, and vomiting; but these were not general or lasting symptoms. The muscular debility was present in all the cases. An unpleasant taste was felt in the mouth. There was slight

pain in the abdomen, on pressure, especially in the region of the bladder. The secretion of urine was suspended in some cases, in others it was free, but passed with pain or effort. The action of the heart was feeble, and the breathing unaffected. The face was pale, and expressive of anxiety; the surface somewhat cold, the mental faculties unimpaired. One of the two fatal cases died in three hours, the other in six or seven hours. In one case only did the symptoms of irritation pass into those of inflammation of the digestive canal. The instance which was treated by me within the tropics was characterized by constant vomiting, by remarkable loss of muscular power, by rapid failure of the heart's action, coldness and clamminess of the surface, and sinking, with intermissions of the pulse. This form of fish poisoning may be called the *paralytic*, or vitally depressing, this condition predominating over the irritant.

[We have known vomiting, and all the symptoms of acrid, irritant poisons, produced by eating of halibut, crabs, lobsters, oysters (out of season), mussels, &c. In one instance, a family of six were poisoned by eating mussels, of which one died, with all the symptoms of aggravated cholera morbus. Dr. A. C. Post has reported a case of poisoning, from eating a portion of the liver of the halibut, in the *New York Journal of Med.*, vol. i., p. 101. The patient was attacked soon after eating with pains, nausea, vomiting, and headache; and soon after the skin began to exfoliate from his face, and successively from every part of the body. The disease went off in a few days under the use of diaphoretics and the warm bath.]

430. (*b*) In the other form of poisoning by fish, cutaneous eruptions, with or without asthma, or asthmatic symptoms without external eruption, are generally present, and signs of local or general irritation predominate. From one to two or three hours after eating the fish, especially mussels, uneasiness, or sense of weight at the epigastrium; heat, and constriction of the mouth and throat, with thirst; numbness, prickings, and itchings of the surface, particularly of the extremities; difficulty of breathing, lachrymacation and swelling of the eyelids, and an eruption resembling urticaria are complained of; but sometimes the eruption is papular, sometimes vesicular, and it is always attended by heat and itching. These symptoms are sometimes attended by vomitings, by colicky pains and diarrhœa; but these are often absent, or of short continuance. In the cases related by Mohring, the eruption was preceded by dyspnœa, lividity of the face, insensibility, and convulsions. In Dr. Burrows's cases, the symptoms began with dyspnœa, nettle-rash, and swelling of the face, conjoined with vomiting and colic; delirium and convulsions supervened, and death took place in three days. In Mohring's cases the symptoms appeared in a few minutes; in those by Dr. Burrows not until twenty-four hours after eating.

431. (*c*) Fish kept too long before or after having been cooked, or otherwise spoiled, especially salmon and shell-fish, has, in two or three instances which I have observed, produced symptoms differing more or less from the two forms of fish poisoning now described. The poison causing the above effects exists in the fish when cooked, is present in the fresh or live state, and is not produced by changes that have taken place, either after death or after cooking. But the injurious effects occasioned by such changes as occur after the death, or the cooking of the fish, are different from the foregoing; and are not attended by either the rapid sinking of vital power on the one hand, or the dyspnœa and eruption on the other. The injurious operation in the circumstances now stated, very much resembles an attack of colic, with vomiting, or an attack of cholera; there being generally severe vomiting with griping pains, occasionally purging with cramps of the extremities, much debility, and sinking of the pulse; but these latter symptoms are not so severe as in the first form, and death has not occurred in any of the cases which I have seen.

432. *b.* The *source of the poison*, in these cases and forms of fish poisoning which are produced by fresh fish, has been a matter of speculation. In the numerous cases observed by Dr. Combe the mussels were fresh, plump, and healthy-looking; and Dr. Christison analyzed some of those which were taken from the stomach of one of his patients without being able to detect a trace of copper, to which the poisonous operation of fish has been attributed. That idiosyncrasy has, as Dr. Edwards contends, something to do with the injurious effects of fish, is true in few or rare instances. Dr. Christison remarks, that a relation of his could not partake of salmon, trout, herring, turbot, or lobster, without being attacked with violent vomiting; and several instances of the kind have been mentioned to me by persons who have possessed this peculiarity; to which, however, fish poisoning cannot be imputed in the great majority of cases. In the nearly fatal case seen and treated by me in a most intimate friend now living, who was never disordered by any kind of fish on any other occasion, and has always been in the habit of partaking freely of every kind of fish, no such idiosyncrasy existed. The mussels, which proved to be poisonous to thirty persons in Leith, were minutely examined by Drs. Christison, Combe, and Coldstream; and it would appear that nothing particular was detected in their appearance; excepting that the liver appeared much larger, darker, and more brittle than in the wholesome fish. The poisonous mussels were all taken from one spot, and every person who partook of them was more or less severely affected, according to the number who ate of them. Animals suffered as severely as man, a cat and dog having been killed by them. It is very probable that, as respects these mussels, and perhaps also as regards some other shell-fish, the poisonous principle exists in the liver, as suggested by the statement of Dr. Christison, but what that principle is has not been ascertained. In the cases of poisoning of two women by mussels, M. Bouchardat states, that he detected sufficient copper to account for the effects; but it is not detected in most cases, and even when present, the quantity found is too small to account for the poisonous effects on the human subject. There can be no doubt, as I have suggested above, that much of the injurious effects of various kinds of shell-fish, eels, &c., arise from a sickly state, produced by the means used to bring them alive to market, and that the choleric and colicky symptoms described (§ 431) as

being often produced by salmon and other kinds of fish, aris echiefly from changes subsequent to the death and cooking or preserving of the fish.

433. *c. The treatment of fish poisoning* should depend much upon the time that has elapsed from the eating of the fish until the commencement of the symptoms; and this may vary from a few minutes to twenty-four hours, or even more. If the period has been short, and the fish still remains in the stomach, an active emetic, as mustard, or the sulphate of zinc, should be given with a large dose of capsicum, and the vomiting encouraged by means of diluents, conjoined with stimulants, aromatics, spices, &c. The elapse even of a long period between the ingestion of the fish and the appearance of disorder, should not prevent a recourse to emetics, for the fish may, in its poisonous state, remain long unchanged in the stomach. If vomiting has taken place without the aid of an emetic, it should not be considered sufficient unless there has been an abundant discharge of undigested or other matters, the treatment now advised being required nevertheless. If the irritability of the stomach become excessive, it will be of no avail to attempt to remove it hy means of opium and effervescing draughts, unless they be conjoined with powerful stimuli and warm spices; for this state of the stomach is always in fish poisoning attended by sinking of the vital powers, especially of the heart's action, and by colicky pains and flatulent distention of the bowels. Powerful stimulants, aided by warm embrocations, rubefacient epithems, or sinapisms, over the epigastrium and extremities, are then required. I believe that capsicum—the true cayenne—or small bird-pepper—is an antidote to fish poison, when taken freely. In the nearly fatal case, which I treated within the tropics (§ 429), after other means had failed to allay the vomitings and rally the powers of life, and after brandy and water had been thrown off the stomach, a teaspoonful of powdered *cayenne* was mixed in a tumblerful of hrandy and water (equal parts of each), and taken at a draught. All the symptoms were instantly mitigated, and the next day nothing more than debility was complained of. That the constant vomitings attending this and some other states of poisoning is owing to more than irritation—is owing in some degree to exhaustion of vital power, is shown by the instant arrest of both the nausea and the vomitings by so powerful an excitant as that now mentioned, and which I have prescribed in somewhat similar conditions with equal advantage. I have employed this spice, especially in an early part of my practice, and in malignant diseases, in very large doses, believing that it is not so irritating to the stomach as its impression on the nerves of the mouth and palate would indicate, but that, on the contrary, it imparts a salutary stimulus to the digestive canal, and counteracts the influence of many depressing agents. If the poisonous fish have passed into the bowels, causing colicky pains, flatulent distention of the abdomen, and sinking of the vital powers, enemata, containing spirits of turpentine, with castor oil; and, in extreme cases, asafœtida or capsicum, or both, should he administered and repeated, according to circumstances, and the warm turpentine embrocation or epithem ought to be applied over the abdomen.

434. *B.* Poisonous Meats.—Certain kinds of meat are sometimes poisonous even in a fresh state, independently of any disease. Others are poisonous owing to some disease of the animal at the time of death. Others, again, are injurious in consequence of changes which have occurred after the animal has been killed—these changes arising either from the deposit of the ova; or exuviæ of insects—from fly-blowing, or from decomposition, or the more slowly developed combinations of the elementary particles which take place in imperfectly preserved or salted provisions, especially in sausages, dried meats, bacon, &c. The secretions of certain animals are poisonous during their lives, especially those possessed by them for the purposes of self-preservation; and the fluids and secretions of others are sometimes poisonous, both during life and after death, owing to the nature of the disease of which these animals are the subject. These latter infect the healthy, contaminating the fluids and soft solids. They are fully considered in the articles Blood, Disease, and Infection, and in those devoted to the specific forms of disease to which they give rise. Some notice is also taken of certain of them when treating of *Septic Poisons*.

435. *a. Fresh pork* is often injurious, and gives rise to various symptoms, according to the idiosyncrasy of the individual and to the manner in which the animal had been fed. In the East, especially in warm climates, pork is often injurious, and productive of diarrhœa and dysentery; effects which I have seen caused hy it in several instances in this country. The Mosaic law forbade the use of it; and there can be no doubt of the wisdom of this law as respects warm countries, and I believe as regards all countries. The *poisonous effects* of fresh pork vary. In the most severe cases it has produced a dry and burning sensation in the throat, with heat and pain in the stomach, retchings and vomiting; a sense of sinking at the epigastrium; a weak, small, and irregular pulse; coldness of the extremities, a cold and clammy perspiration, and colicky pains in the abdomen and around the umbilicus. In other cases the pain has been confined to the stomach alone, or it has been situated in some other part of the abdomen. In addition to these symptoms, there have sometimes been remarkable swelling of the face extending over the scalp without any vesication or redness, swelling and tenderness of the abdomen, an eruption resembling urticaria over the breast, legs, and arms, and a quick, sharp pulse. In rarer instances, there have been neither retchings nor vomitings, hut severe colicky pains, and sinking of the pulse and vital powers. Such were the more acute cases of poisoning with pork, and of which Dr. M'Devitt has detailed six cases, all of which were produced hy fresh or recently salted pork, and especially hy roasted pork. He believes that the injurious effects are produced chiefly by the fatty parts; but I have reason to believe that the viscera are still oftener injurious. [In this country, a preparation of pork called *head-cheese* is more frequently injurious than any other variety of this food, and this is probably owing to incipient decomposition in the centre, as in the case of the German sausages.]

436. The symptoms may appear any time from three or four to thirty hours after the in

gestion of the meat. When the symptoms are delayed until seven or eight hours after the pork has been eaten, they much resemble those of either violent colic or enteritis, and are attended by a sense of sinking or of impending dissolution, and a weak, intermitting pulse, &c. In other cases, especially when a longer period than this has elapsed from the ingestion of the poisonous food—from twelve to twenty-four hours—diarrhœa, or an attack resembling cholera, or dysenteric symptoms of a severe character, have taken place. In many instances the symptoms are slight, especially when the offending article has been evacuated speedily by vomiting or by copious evacuations from the bowels; and even when the symptoms assume an alarming character, the discharge of it, when fully accomplished, is followed by immediate relief of all the symptoms. When only one, of several of those who have partaken of this food, has been thus affected, then we may infer either that the affection is owing to idiosyncrasy, or that the part eaten by the individual has been tainted or otherwise changed; but I am acquainted with occasions on which great numbers of persons, as a large portion of a regiment of troops, have been affected after eating fresh pork, some very severely, with the symptoms above described, or with diarrhœa, or colic, or dysentery.

437. *b. Bacon* seldom produces symptoms of *acro-sedative* poisoning unless those parts of it generally on or near to the surface, which have undergone change during the process of preserving, or near the large vessels. Mr. Taylor states, that one fatal case from poisoning by bacon occurred in the metropolis in 1836; and I have seen very severe effects produced by a minute portion of a spoiled or rusty part of ham or bacon having been swallowed. But equally severe and nearly similar symptoms have followed the ingestion of a very small piece of either *mutton* or *veal*, when fly-blown or otherwise changed. Mr. Taylor states, that meat of any kind, when too recently killed or decayed, may produce severe effects, and even death. I believe, however, that decay, unless far advanced or connected with the deposition of the ova or exuviæ of insects, or the generation of mouldiness, or the lowest forms of animal life in the preserved articles, will not produce of itself the severe symptoms constituting acute or fatal poisoning.

438. *c. Animal substances of various kinds* have become poisonous, owing to changes during their preservation, which Dr. Christison has called a "*modified putrefaction*." In Germany and other countries, where animal substances are preserved by drying and smoking chiefly, and without much salt, some unknown injurious principle appears to be developed in these substances from the combinations of their elementary particles during the process of preservation. The articles in which these injurious changes have been observed are sausages, bacon, and hams, dried mutton and beef, cheese, smoked salmon, and various other dried or preserved animal substances.

439. (*a*) *Sausages* have proved most frequently poisonous; but it is possible that they may, at least in some instances, have possessed this property independently of any changes during their preservation, and that it may have existed in the flesh or viscera of the animal, especially the pork, when quite fresh, of which the sausages were made. This circumstance is rendered the more probable by the accounts of three cases which terminated fatally from the effects of sausages made with the liver of an apparently healthy pig slaughtered only a week before. The *inspection* of the bodies threw no light on the more immediate cause of death in these cases. (*Lond. Med Gaz.*, November, 1842.) But the poisonous effects so frequently observed in Germany to be produced by sausages more evidently are developed by a modified putrefaction or by a combination of the elementary particles, taking place during the process of preservation, and different from the usual states of putrefaction. The sausage poison has been described by Dr. Christison from the materials furnished by Kerner, Dann, and Horn. In a period of little more than thirty years, 234 cases of sausage poisoning occurred in the state of Würtemberg, and of that number 110 proved fatal. Those sausages which have been found poisonous have usually been of large size, and cured by drying and smoking with wood. They become deleterious in the spring after they have been long kept, and been alternately frozen and thawed; and are poisonous only at a particular stage of decay, and cease to be so when putrefaction has fully advanced. Those that are poisonous possess an acid reaction, are soft, have a nauseous putrid taste, and an unpleasant sweetish-sour smell. The central parts are chiefly deleterious, these parts being poisonous even when the surface is wholesome.

440. (*b*) The *poison of cheese*, as observed in several Continental countries, and rarely in this, appears to be developed by analogous changes in the curd to those observed in sausages; and is more properly developed by a partial decomposition having taken place in the curd before it was subjected to pressure, than by any change subsequently to this process. Dr. Christison thinks that the cheese poison is occasionally met with in Cheshire, where among the small hill-farms the limited extent of the dairies obliges much of the curd to be kept for several days before the quantity required for large cheeses is accumulated.

441. *d. The symptoms* produced by spoiled *sausages*, *cheese*, *bacon*, *hams*, and *salmon*, which has become partially decomposed before, or after being cured, are probably very nearly the same in respect of each of these articles; but they have been more frequently and precisely observed and described as regards the ingestion of spoiled sausages. Generally, the effects of these are not manifested until twenty-four hours, or two, three, or even four days after they have been eaten. This tardiness of operation is probably owing to the difficulty of digesting them, and the slowness of their absorption. The first symptoms are pain in the stomach, vomiting, purging, dryness of the mouth and nose, and hoarseness or loss of voice. Deglutition becomes difficult and painful; the pulse fails, swoonings ensue, and the skin is cold and ultimately insensible. The eyes, eyelids, and pupils are almost motionless. The secretions and excretions are at last suspended, but often profuse diarrhœa continues throughout. Fever is rarely present, and the mind continues unaffected. Fatal cases end with convulsions and

oppressed breathing between the third and eighth day.' In cases of recovery, convalescence is very long protracted.

442. *e. The appearances on dissection* have been described as observed in cases of sausage poisoning. There are usually signs of inflammatory irritation in the internal surface of the digestive canal. The throat is white and dry; the œsophagus thickened; the stomach and intestines reddened, and croupy exudations are formed on the surface of the trachea. The heart is flaccid, and the body is said to resist putrefaction. But it is evident, from this account, that the structural changes consequent upon poisoning by these articles of food have not been observed with due care and precision.

443. *f. The treatment of poisoning by pork, or by sausages, preserved meats, and other articles too long kept or imperfectly prescved*, should not differ materially from that recommended for fish poison. The chief indication is to procure the discharge of the offending substance as speedily as possible, by means of the emetics conjoined with the warm spices already mentioned (§ 433). If it be inferred that it has passed the pylorus, the enemata advised for fish poison, and the external applications also recommended, should be resorted to. In cases of poisoning by these substances, *creasote*, conjoined with warm spices, with small doses of opium, and with ipecacuanha if diarrhœa or dysenteric symptoms appear, will be found of great service, especially when the stomach becomes irritable. In most cases, also, mustard poultices, or turpentine epithems, over the epigastrium or abdomen, will be of service; and they ought never to be omitted in the more acute and dangerous cases.

444. *C.* Diseased Animal Substances, Fluids, Secretions, &c.—*a. The flesh of over-driven animals*, especially if these animals have been deprived of drink for some time before they were killed, and probably also their viscera, produce injurious effects, especially in cachectic constitutions. But, according to the experiments of M. Morand, the flesh of such animals is perfectly wholesome when cooked and eaten, although the application of the blood, or raw flesh, to a scratch or wound, or even to the sound skin, is often followed by dangerous or fatal effects: sometimes consisting of an eruption of gangrenous boils, the *pustules malignes* of the French, at other times appearing as diffuse inflammation of the skin, or of the cellular membrane, or of both.

445. *b.* The *viscera and offal* of animals occasionally produce analogous effects to these just mentioned, even on the unabraded surface Sir B. Brodie has shown that the contact of these with abraded or wounded parts may cause chronic states of erysipelas, &c. I have seen several instances of the scratches or pricks of the fingers of cooks by the bones of hares or of other animals, and even abrasions of the skin, having been followed by inflammation of the absorbents or of the veins, or by diffusive inflammation of the cellular tissue.

446. *c. The flesh or viscera of diseased animals*, and especially of those which have died of endemic or epidemic distempers, are undoubtedly injurious, and even in some instances rapidly fatal. Mr. Taylor states, that four members of a family in Oxfordshire, in the spring of 1841, dined in good health upon part of a sheep which had died of a disease then prevalent among cattle. The symptoms which followed this meal resembled those of irritant poisoning, accompanied by others indicating an affection of the nervous system. One of the patients, a child, died in less than three hours; the others recovered. There was no poison discovered in the food, nor in the body, nor was any poisonous vegetable used at the meal. (*Op. cit.*, p. 214.)

447. *d.* There are certain districts in North America, in which the *milk and flesh of animals*, especially cattle, acquire poisonous properties from the grass [or some vegetable] on which they feed. The disease thus produced in persons who partake of this poisonous food has been named in America the "milk-sickness," or "trembles." These districts lie to the west of the Alleghanies, and those who venture within them are obliged to abstain from the flesh of the cattle within the same limits, as well as from the milk and its preparations. It appears from the report of Drs. Hosack, Post, and Chilton, that the inhabitants of some of these districts, with a reckless disregard of human life, carry the butter and cheese, which they dare not themselves eat, to markets at a distance; and that thus symptoms of poisoning, and even death, for which the medical attendant cannot account, are frequently produced. According to the same report, the cattle from these districts are sent in great droves over the mountains, but, in order to deceive the purchasers, they are sent to New York by a southern route. The flesh of these animals occasions aggravated symptoms of cholera. "The viscera of these cattle are often found diseased; the livers most generally so." Owing to the symptoms of poisoning which have followed the use of beef, butter, and cheese from these districts, the American government caused a medical inquiry to be instituted into the matter, and the reporters recommended the sale of these articles to be prohibited. In the event of this recommendation being adopted, it is not improbable that the poisonous food may be exported to England. (See *Edin. Med. & Surg. Journ. for July*, 1844.)

[Cases of poisoning by eating smoked beef, cheese, head-cheese, and ham, are not of unfrequent occurrence in this city. In December, 1841, about forty cases of poisoning from eating smoked beef occurred in a particular neighbourhood, all of which could be traced to the same source. About nine hours after partaking of the food, pain and uneasiness were experienced at the præcordial region, which, extending to the back and loins, were only temporarily relieved by the dejections which followed: vomiting now supervened, attended with great thirst and a burning sensation at the pit of the stomach; indeed, the irritability of this organ soon became so great, that no substance, either as food or medicine, could be retained by it for an instant. These symptoms soon assumed the most aggravated form; extreme prostration followed; the functions of the nervous, muscular, and digestive systems were much impaired, and the period of convalescence was very protracted and tedious. In one case only did the attack prove fatal. There can be no doubt, I think, that the poison was generated by partial decomposition after the death of the

animal; or it is possible that the animal which furnished the beef was diseased. Analysis proved that the beef contained no mineral or vegetable poison. A decoction made from it, when thrown into the circulation, caused death in about three hours and a half; while a similar preparation, made from sound beef, produced no morbid signs in the animal experimented on.

A peculiar endemic prevails in certain portions of the Western States, called the *milk-sickness*, or *trembles*. The former name has its origin in the circumstance that the disease is frequently communicated to man by the use of the milk or butter of an infected animal, though it will be as readily produced by eating the flesh; and the latter name arose from the symptoms of a *trembling motion* of the voluntary muscles manifested in cattle. Horses as well as cattle die by the poison, and dogs, cats, buzzards, turkeys, chickens, and crows die by eating the flesh of animals that have perished by this disease. Sometimes the animals are affected to that degree that their flesh and milk will produce the disease in man, and yet they themselves manifest no unhealthy symptoms whatever. (*American Med. Recorder*, vol. vi., p. 257). Dr. Graff, of Edgar county, Illinois, says, "Hundreds of persons throughout the West and Southwest are annually perishing from its attacks. Butter and cheese manufactured from the milk drawn from the infected cows are supposed to be the most concentrated forms of this poison. They possess no distinguishing appearance, colour, or taste from the healthy article. A very minute quantity of either will suffice to develop the disease in man. The cream ordinarily to be added to the coffee drank at a single meal is said to have induced an attack. The butter or cheese eaten at one repast has frequently been known to prove effective. The property is not contained in any of the elements of the milk exclusively, but distributed throughout the whole of them, being possessed by the buttermilk as well as the whey." The same writer remarks (*Am. Jour. Med. Sciences*, 1841), "That a murderous practice is now carried on in certain districts, in which the inhabitants will not themselves consume the butter and cheese manufactured, but, with little solicitude for the lives or the health of others, they send it in large quantities to be sold in the cities of the West, particularly Louisville, Kentucky, and St. Louis, Missouri." The committee who reported upon the subject of poisoned beef, already referred to, Dr. Francis, chairman, observe, "From the inquiries which we have made, we have ascertained that immense droves come from the West to supply our markets; they are driven across the mountains and reach New York from the south; hence they are called by the dealers 'Southern cattle.' Many of these cattle become diseased on the route, and are then exchanged for the pasturage of the herd. In this condition they are frequently slaughtered by the farmers, the flesh sent to the city and exposed for sale, producing in persons who make use of it symptoms of aggravated cholera morbus. Physicians attest that they have frequently met with such cases, which it was impossible to account for in any other way." It is a well-known fact that the liver, in southern and western cattle, is very liable to be diseased; so much so that it is always cast away, it being actually unknown as an article of diet. The late Dr. Forry observes (*N. Y. Journ. of Med.*, Nov., 1843), "Among the cattle of our western country, and especially of Ohio, there are frequently found in the liver the most extraordinary heterologous formations. This viscus is often discovered completely studded with osseous sacs, containing a dark grumous fluid, in which lives a species of entozoa, having physical characters almost identical with the native leech. Of these leeches, as many as fifty or sixty may be found in a single liver, so that not a cubic inch of normal liver remains." The cause of the milk-sickness is as yet unknown, though it is generally attributed to some poisonous vegetable.]

448. The above interesting and important fact is an ample illustration of what has been stated by some physiologists, namely, that certain secretions may acquire poisonous properties from the nature of the ingesta, without the individual appearing to be materially disordered. I have repeatedly had occasion to observe, that the *milk of a nurse* has produced all the symptoms of slow poisoning, occasioning vomiting, diarrhœa, and sinking of vital power, with or without convulsions in the child which she suckled; and that this state of the milk has not been occasioned alone by the nature of the ingesta, but also by the more violent mental emotions. That the nature of the food may thus affect the secretions without materially disordering the animal, is farther shown by the poisonous nature of the *honey* in some districts, as that of Trebizond, which is said to be collected from poisonous plants. I believe that the deleterious effects of pork are chiefly owing to the unwholesome nature of the food upon which the animals had lived for some time before they were slaughtered.

449. *e. Poisonous honey*, especially as met with in Trebizond, causes, according to Mr. Abbot, violent headache, vomiting, and a condition resembling intoxication. A large dose produces deprivation of all sense and power for some hours afterward. These effects agree with those mentioned by Xenophon, in his account of the "Retreat of the Ten Thousand." Pliny also takes notice of this poisonous honey. Tournefort ascribes this property to the bees feeding on the *Azalea pontica*. (*Lond. & Edin. Philos. Mag.*, vol. v., p. 314.) The poisonous effects of honey have also been observed in North America, by Drs. Barton and Hosack, who consider that the injurious property is owing to the various species of *kalmia*, the *Andromeda mariana*, the *rhododendron*, the *Azalea undiflora*, and the *datura* on which the bees have fed. The *symptoms* mentioned by Dr. Barton are dimness of sight, or vertigo, succeeded by a delirium, which is sometimes mild and pleasant, and sometimes ferocious; obriety, convulsions, with foaming at the mouth; pain in the stomach and intestines, vomiting, purging, and, in a few instances, death. Sometimes vomiting is among the earliest symptoms, and in that case the patient is readily relieved, although a temporary weakness of the limbs remains. (*American Philosoph. Trans.*, vol. v., p. 65.) In the cases recorded by Dr Hosack, the chief *symptoms* were violent vomiting, cold extremities, a livid appearance of the counte-

nance; the pulse having been remarkably reduced. In these instances the honey was of a dark-reddish colour, and of thicker consistence than usual. (*Edin. Philosoph. Journ.*, vol. xiv., p. 91.)

450. *f.* The treatment of poisoning by the *flesh of diseased animals* (§ 444–448), judging from the effects or symptoms as far as they have been described, should not materially differ from that which I have recommended for poisonous fish (§ 433). Having expelled the injurious substance by emetics, and by purgatives and enemata, if it have passed the pylorus, the powers of life should be developed by means of the tonics, stimulants, aromatics, spices, external applications, &c., there prescribed; and especially quinine, camphor, capsicum, and opium. In the cases of *poisoning by honey*, just noticed, the efforts of nature suggested the best remedy, namely, the early discharge of the injurious substance from the stomach and bowels by emetics and purgatives. I believe that, in all cases of poisoning by injurious articles of food, the best purgative that can be employed is, a combination of spirits of turpentine, castor oil, and capsicum, taken on the surface of coffee, or some aromatic water; enemata, containing the same medicines, being also administered according to the circumstances of the case.

451. vi. Mineral and Saline Acro-Sedatives.—*A.* The Antimonial Compounds act as irritants of the surface or part to which they are applied, and, owing to their absorption chiefly, and probably also to their more immediate influence upon the nervous systems, they depress vital power and vascular action. The *chloride of antimony*, the preparation which is the most corrosive and irritant, has been noticed above (§ 175, *et seq.*), and shown to be injurious principally in consequence of its local effects. But the other officinal preparations of antimony exert a much more remote and extensive influence, more especially the *potassio-tartrate*, the *sesquioxyde*, the *oxysulphuret*, or kermes mineral, and the *compound antimonial powder*, which was intended to represent the empirical powder of Dr. James. The medicinal properties of these preparations differ more or less; but, when given in excessive doses, the first, or the *potassio-tartrate of antimony*, may be considered as representing their injurious effects, both local and constitutional. When treating of it, therefore, my observations will apply also to the other compounds of this metal.

452 *a.* The *antimony-tartrate of potash*, or *potassio-tartrate of antimony*, or *emetic tartar*, is a powerful irritant when applied to any part, or even to the cutaneous surface, in a state of minute division or strong solution; and generally causes an eruption of painful pustules resembling those of ecthyma or small-pox, and various constitutional changes, according to the dose and the mode of employing it. As this preparation is the most prescribed, it is of importance that its *local* and *remote effects* should be well understood. (*a*) When applied to the *cutaneous surface*, *emetic tartar* gives rise to somewhat different results, according to the mode of its application. In a state of strong solution it occasions an eruption of small semiglobular painful pustules; in that of powder sprinkled over a plaster, or mixed in an ointment, the pustules are larger, and, when fully developed, are flattened, with a central dark point, contain a puriform serum and an albuminous deposit, and are surrounded by an inflammatory border. The central dark point soon extends, and forms a dark crust as desiccation of the pustules advances, that is afterward thrown off. The internal use of this substance in large or poisonous doses sometimes gives rise to a similar pustular eruption, or to aphthous spots, in the mouth, fauces, pharynx, œsophagus, and intestines, but more frequently to redness, and other inflammatory changes in the gastro-intestinal villous surface; attended by pain in the region of the stomach extending over the abdomen, and by vomiting, followed by purging.

453. (*b*) *The constitutional or remote effects* of tartar emetic and other antimonial preparations vary with the dose. In *small doses* emetic tartar increases the secretions of the liver and pancreas, and the secretions and exhalations of the gastro-intestinal villous surface; and as it passes into the circulation, it increases subsequently the perspiration and the mucous and urinary excretions. In *larger doses* it excites nausea and vomiting, relaxes the skin, and augments the mucous secretions and exhalations. In still larger quantities it depresses the organic nervous energy, relaxes the muscular structures and all the tissues, and gives rise to general exhaustion. With its emetic operation it occasions distressing nausea and sinking, and is sometimes uncertain in the amount of its effects, the emetic action being slight, while the depression and diarrhœa produced by it are extreme. *Excessive doses* of this substance have acted as a violent irritating and depressing poison, and produced death, especially in children, and infants when it has been given frequently, and in too large quantities for this class of patients; the sinking of vital power and death, which have in no rare instances ensued, having been mistaken for the progress and result of disease. Orfila states that in one case a scruple, in another, twenty-seven grains nearly proved fatal, and that forty grains caused death. The symptoms in these were vomitings, pain and tumefaction of the epigastrium extending over the abdomen, hypercatharsis, delirium, convulsions, and, in the fatal case, death on the fourth day.

454. The above should be viewed as the effects of this substance on the healthy body only, for it has been found that, in states of inflammatory excitement, in local inflammations, and fevers attended by high vascular action, the system will tolerate quantities of tartar emetic, which have been productive of the most dangerous effects in other conditions of the œconomy. This salt has been given in enormous doses by Rasori in these states of disease, and the statements of this physician have been partially confirmed by Laennec and others. I have attempted, however, to give very large doses of it in pneumonia; but, if I advanced above five or six grains in the twenty-four hours, distressing diarrhœa and depression followed the emetic action of it, and I have been obliged to desist. Some source of fallacy must exist, as regards either the purity of the medicine, or the retention of it in the stomach and bowels, from either of which it may have been more or less

completely rejected; or then we must infer that an excessive quantity of it acts less energetically than a very small dose: an inference which receives no support from the external application of it, or when it is administered or applied so that its operation, especially as an irritant, may be subjected to the senses of the observer. It should, however, be noticed, that in cases of oppression of the brain, and of coma, large doses of this salt may be given without producing vomiting, and, if fever be also present, without occasioning any very remarkable effect, until dangerous sinking of the powers of life, or diarrhœa, or both appear. This is the more apt to occur in children and young subjects, and requires more attention than it has received.

455. The symptoms produced by antimonials taken in poisonous doses are, in the majority of instances, such as have been just described; but when taken in states which may affect the mouth or palate, a strong metallic taste is perceived in the mouth, both at the time of swallowing and afterward; and even during convalescence from large quantities, this taste sometimes continues, with an aphthous eruption in the mouth and fauces. There are generally also syncope, small, weak pulse, great prostration of strength, cold, clammy perspirations, vertigo or tremour; spasms of the extremities, convulsions, in the more dangerous cases; and these symptoms generally precede death in fatal cases. Dr. Beck mentions an instance in which fifteen grains of tartar emetic killed a child. I am confident of having seen fatal effects follow the exhibition of a smaller quantity, given in divided doses, in cases of croup to which I had been called.

456. *b.* Tartar emetic, when injected into the large bowels, or into other mucous canals, produces nearly similar effects to those already described; and is also, in these circumstances, absorbed into the circulation, through the medium of which, as well as when injected into the veins or introduced into wounds, it acts specifically upon the stomach, producing, as M. Magendie has shown, a very decided action on this organ, when thus employed. When applied to the skin, in the form of powder, or of strong solution, to produce an artificial eruption, it rarely occasions any constitutional effects of a severe character, or resembling those occasioned by the ingestion of a poisonous dose. Yet such effects have occurred, and have been attended by nausea and vomitings, and even by diarrhœa.

457. *c. After death*, the villous surface of the stomach and duodenum has been found reddened and covered by a slightly adhering layer of mucus. Mr. Taylor states, that in a man who had taken forty grains of tartar emetic within a period of five days, and who then had died apoplectic, the stomach was found much reddened and inflamed in irregular patches, the redness passing into a violet tint; but there was no ulceration of the internal membrane; the duodenum was in a similar state, and the small intestines were but slightly inflamed. In animals poisoned by this substance it is usual to find inflammation of the gastro-intestinal mucous surface.*

458. *d. Treatment.*—The evacuation of the poison from the stomach by the stomach-pump, or by encouraging vomiting by irritating the fauces, or by the free administration of warm water, milk, or demulcents, should be enforced. Any vegetable infusion containing tannin, or an infusion of green tea, oak bark, or of the yellow cinchona bark, may be given freely; as the tannin combines with oxide of antimony to form an insoluble compound, thereby suspending the operation of the poison. But Dr. Pereira states, that although cinchona decomposes emetic tartar, it does not destroy the activity of this salt; for that, in many instances, from one to two grains of the salt were given with the yellow bark, and nevertheless nausea or vomiting occurred. In most instances of poisoning by the preparations of antimony, opium is most beneficial, especially when conjoined with small doses of camphor, and even of capsicum when the depression is urgent. Mustard epithems on the epigastrium, and the warm bath, and several of the other measures advised for the removal of the effects of other substances already considered under this class, will also be found of service.

459. *B.* Baryta and its Salts are poisons of which but little is known as to their operation on man. Pure baryta is met with only in the laboratory of the chemist; but it is a caustic poison. The principal salts are the chloride, nitrate, acetate, and carbonate, the last of which is insoluble. The sulphate is said not to be poisonous, as it is insoluble; but, as Mr. Taylor remarks, it would be well to establish this by experiment, since insolubility ought not to be received as evidence of the inertness of any substance, although it is erroneously assumed to be so, and is the chief basis of the doctrine of chemical antidotes. Arsenite of copper and calomel are as soluble as the sulphate of baryta, and yet they act powerfully on the body. The instances of poisoning which have occurred from baryta have been caused by the chloride and the carbonate.

460. *a.* The *symptoms* produced by the *chloride of baryta* were a combination of irritation of the alimentary canal, and severe affection of the nervous system, especially vertigo, convulsions, and paralysis. In one case half an ounce was fatal in two hours. In another, one ounce destroyed life in an hour. It has been found to affect the system powerfully even in small doses. Orfila has shown that the chloride of barium is absorbed, especially when given in small or moderate doses. He states that he has found it in the liver, spleen, and kidneys of animals killed by it.

461. The *carbonate of baryta* is said to have been fatal in two cases, in each of which one drachm only was taken. But, in a case recorded by Dr. Wilson, it appears not to have been nearly so virulent. A young woman swallowed half a tea-cupful of the powdered carbonate mixed with water. She had fasted for twenty-four hours. The powder had no taste. In two hours she had dimness of sight, double vision, ringing in the ears, pain in the head, throbbing in the temples, with a sensation of distention and weight at the epigastrium, and palpitation of the heart. She afterward complained of pain in the legs and knees, and cramps in the calves. She vomited twice a fluid like chalk and water.

* [We several years ago reported a case of poisoning by antimony, with the post-mortem appearances, which may be found in Beck's *Med. Jurisprudence.*]

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